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THE FOCAL SPOT

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News Items from the Provinces

ALBERTA SOCIETY OF RADIOLOGICAL TECHNICIANS

CALGARY BRANCH

Since the January edition of The Focal Spot the Calgary Society has been at no standstill, a fact for which we now have financial proof. Under the supervision of Mrs. McIntyre and Mrs. Frazer. a successful whist drive was held by the women members of the society;—watch out, men! your turn is coming.

Our regular monthly meeting for February was enriched by a talk by Capt. Bell, Radiologist at the Colonel Belcher Hospital, on "Unusual Chest Films." Following through with this topic, the March meeting saw the fulfillment of a talk on the "Mobile Clinic," by Mr. Nelson, of the Keith Sanitarium.

The Calgary Society would like to take this opportunity to extend its sincere congratulations to Dr. McGuffin on being awarded, by the College of Western Ontario, the honorary degree of Doctor of Laws. We are proud to be associated with you, Dr. McGuffin.

Best wishes for a successful year are extended to the newly formed Lethbridge Society.

We were happy to welcome at our January meeting Miss Moffat, from Winnipeg, and in March, Miss Luckroft from Prince Albert, Saskatchewan.

—M. B., Calgary
Sub-Editor.

EDMONTON BRANCH

The Provincial Society is proud to say that we now have ninety members throughout the province. Plans are well on the way for a Provincial convention this summer at Sylvan Lake.

A large attendance was on hand for the Edmonton annual banquet held in January. By the kindness of the Department of Extension we were provided with some interesting and amusing films.

At our regular February meeting, Mr. B. Merrin, a well known western representative of the DuPont Film Products, gave us a very interesting talk with pictures on the production of x-ray films and advantages of the high speed camera.

The April meeting was held and final instructions were given to the seven students who plan to write the examination on April 13th. Best of luck to them.

Our best wishes go to Miss Marion Duggan who is to be married this month.

We are happy to welcome seven ex-servicemen and women; Mr. J. Bateman, Mr. R. McQueen, Mr. R. Smith, Mr. N. Goodall, Mr. A. Sharawara, Miss Jennings and Miss L. Smith, to our Edmonton Society.

—F. DYLKE,
Sub-Editor.

NEW SOCIETY FORMED IN LETHBRIDGE

The newly formed group of Radiological Technicians centred in Lethbridge held their second meeting in St. Michael's Hospital on April 8th. As they were anxious to join with our Provincial Society, Mr. H. Welch of Calgary and myself journeyed to Lethbridge to be with them at this meeting. We were warmly received by the chief technician, Sister St. John of the Cross, Dr. Ross the Radiologist and the assembled technicians. Mr. Welch acted as chairman and the group showed keen interest in the general discussion of Dominion and Provincial matters.

Mr. Welch gave a detailed account of the work carried on by the Dominion Executive, and to wind up a very pleasant and instructive evening a delicious lunch was served by the Hospital.

We welcome these new members into our Association, and promise them all the help we can give.

Pending the adoption of a constitution, the following temporary officers were elected:—

(continued on page 56)

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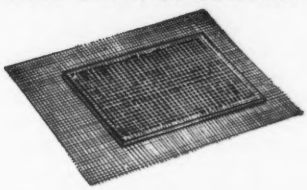

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Perhaps it may not be out of place here to say that Lethbridge is a beautiful little city situated in Southern Alberta, the streets are wide and clean, and for its size it has surprisingly fine buildings.

The next two days were spent in Calgary, where I became acquainted with several of our members in that city. After a long conference with our Provincial Vice-President, Miss Francis Shaw, and with the help of our old friend and ex-technician, Mr. Cam White, the details of our proposed Provincial general meeting were arranged. This will be held at Sylvan Lake on June 16th.

Through the kindness of Mr. Welch, I was his guest during my stay in Calgary and we had ample opportunity to talk over Dominion matters. It was an eye-opener to me to see what a volume of correspondence is so ably handled by our Dominion Officers, and I feel that they deserve commendation for their work for the Society. We are very fortunate in having here in the West two members of the Dominion Executive, Mr. Herbert Welch of Calgary and Mr. Percy Hunt of Saskatoon, our Dominion Secretary. How these two manage to get through the volume of work that has been given to them is a marvel to me. I also found that our Directors in the East have by no means been idle. Special praise goes to Mr. L. J. Cartwright, Editor of The Focal Spot. Comments by Radiologists on our magazine show how splendidly it is put together.

I was sorry to hear that our Dominion President, Mr. T. Hurst, has been confined to hospital. By the time this is in print I hope that he has fully recovered. I would once again like to remind all members that the Dominion Executive is staffed by officers who are doing a grand job and I withdraw any unkind thoughts I may have had in the past. —C. N. GODWIN, Edmonton, President, Alberta Society of Radiological Technicians.

BRITISH COLUMBIA SOCIETY OF X-RAY TECHNICIANS

Meetings have greatly improved both in attendance and in interest in the past few months. The January meeting was held at the home of Mr. Jack Blair of Victor X-Ray Corporation. After a short business session, Mr. and Mrs. Blair entertained our members to a very pleasant and enjoyable party. Everyone was enthusiastic and the members were heartily in favor of all our meetings being on a similar basis. A very cordial vote of thanks was extended to Mr. and Mrs. Blair for their generosity and hospitality.

The February meeting was held in St. Paul's Hospital and was very well attended. Dr. Campbell of St. Paul's Hospital gave a very instructive and interesting talk on Myelography. As this is a subject which we do not very often have an opportunity of discussing it proved to be most engrossing and enlightening. Dr. Campbell illustrated his lecture with many films and we found this very helpful. The hearty vote of thanks extended to Dr. Campbell was well merited.

A large number of members attended the March meeting in St. Paul's Hospital when Dr. G. L. Wood spoke to us on Retrograde and Intravenous Pyelography. It was most interesting to hear this discussed from a Urologist's point of view. As a result we learned many things which should prove helpful to all of us. Dr. Wood was accorded a very attentive hearing and I am sure the hearty vote of thanks which was extended to him must have made him feel how much his talk was appreciated.

The April meeting was held in the T.B. Control Building when we had the pleasure of listening to a very good lecture on T.B. and X-Ray which was given by Dr. G. F. Kincade. Dr. Kincade had a large number of films to illustrate his points and these were most interesting. The usual vote of thanks was extended to Dr. Kincade and afterwards the staff of the X-Ray Department, under the able hands of Miss Dorothy Bowman, entertained us to refreshments.

The attendance at our meetings has materially improved and as a result the meetings have also improved. We have been most

(continued on page 105)

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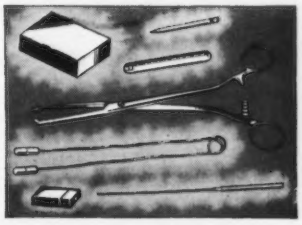

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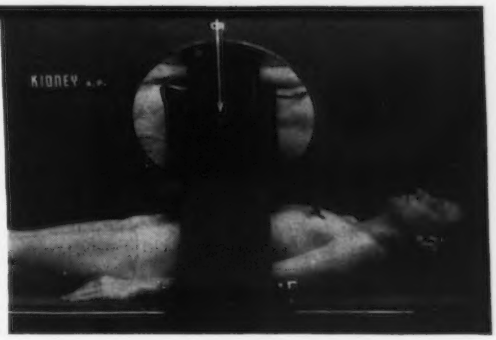

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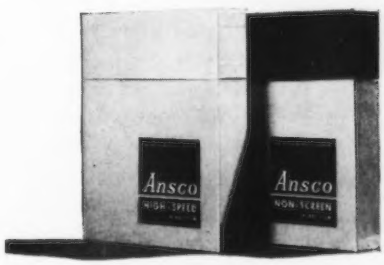

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Journal of the Canadian Society of Radiological Technicians

Volume 3 *APRIL, 1946* *Number 2*

Series and Parallel
Physics Without Tears

EIGHTH STANLEY MELVILLE MEMORIAL LECTURE

By W. E. SCHALL, B.Sc., F.Inst.P., Hon.M.S.R.

It is a privilege to be able to present to our readers, by kind permission of "Radiography," the Journal of The British Society of Radiographers, the Eighth Stanley Melville Memorial Lecture. We feel this has a very timely interest to the members of the Canadian Society in its advocacy of common-sense methods of training technicians. The Lecturer is well known in English Radiological circles as a physicist and is the author of the textbook "X-Rays, Their Origin, Dosage and Practical Application." At the conclusion of the lecture he was presented with a Diploma of Honorary Membership in the Society of Radiographers.

I ACCEPTED the invitation of your Society to deliver the Stanley Melville memorial lecture for two reasons. First, I appreciate very much the honour which you do me in asking for this, and secondly, I welcome the opportunity of paying my tribute to the memory of one who was a very kind friend and an inspiring example.

Great though his achievements were in the diagnosis of chests by x-rays, Stanley Melville will be remembered for two other activities so long as radiology exists in Britain. The first was his work with others in establishing the British X-ray and Radium Protection Committee, at a time when a scare regarding the dangers associated with x-rays had been given publicity in the daily press. The recommendations of the Committee which resulted were adopted internationally at Stockholm in 1928. The second, of which I want to say more this evening, was his work in organizing education in radiology—and in this he showed himself to be a good and true friend to your Society over a period of many years.

Stanley Melville had been trained for the legal profession before he became a doctor, and perhaps this was the cause of his slow, deliberate speech and the thought which he gave to any answer before he made it. Probably, however, this and his unfailing kindness and old-world courtesy were just a part of the man, an inherited rather than an acquired characteristic. I well remember seeing him early one day in his little room in Chandos Street and asking whether he had read something or other of importance in that day's morning paper. His reply was, "Mr. Schall, how do you manage to have so complete a knowledge so early in the morning of what is in to-day's Times? I do hope that you do not read the paper at breakfast when you should devote yourself to your family." I had to confess that I did—and although I still sin in this way, the joy that was mine has gone since that gentle admonition.

It is a happy coincidence that a few days from to-day — on November 8, we celebrate the fiftieth anniversary of the

discovery by Professor Roentgen at Wurzburg, in Bavaria, of the rays — without which there would be no Protection Committee, no radiologists, no radiographers, and no radiological education. This year, 1945, also is the centenary of Roentgen's birth.

Roentgen, the son of a German father and a Dutch mother, was born in 1845 at Lennep, near Dusseldorf, and went to school in Utrecht. There he had the misfortune to be involved with others in the very innocent prank of drawing a caricature of one of his masters. He refused to give his companions away and so came under a censure, the result of which was that permission to take the school leaving certificate examination was refused. Influence was brought to bear and after delay the permission was granted, but ill-luck continued, for the schoolmaster who had worked the oracle died, and in his place one of the outraged staff of his school was now on the examining board. The result was that Roentgen failed. He proceeded to Zurich to study engineering. He obtained his diploma in mechanical engineering — but his chief interest lay in the direction of physics. At this time, Kundt, who is famous in the physics of sound, was Professor of Physics at Zurich — and he recognized the experimental aptitude of his pupil. When Kundt became Professor of Physics at Wurzburg he wished to appoint Roentgen to the assistant professorship. Red tape intervened because an ancient University like that of Wurzburg could not possibly give an assistant professorship to a man who had not passed the school certificate and who knew nothing of Greek and Latin — in spite of his notable achievements in physics even at that time. Kundt then went to Strasburg as Professor, and at this much younger and less rigid University he was able to have the service of Roentgen as assistant in 1874. From there Roentgen went to Giessen in 1879 as Professor of Physics, and finally was called to Wurzburg in 1888 in the same capacity. It must have given him very great satisfaction to be appointed to this post at the very University which seventeen years before had frowned on his lack of classical and examination qualifications.

It was here on November 8, 1895, whilst experimenting on the passage of electricity through gases, that he discovered the rays which he himself called X rays — X being the unknown. He published his first report in the "Proceedings of Wurzburg University" — the report being dated December, 1895, and the publication taking place early in 1896.

Two points strike you when you read this paper. The first is the absence of all mathematics and formulae — Roentgen was an experimental physicist and, like Faraday, believed in describing what he saw in plain language. The second point is the completeness of his description. He seems, in those first few weeks, to have noted everything of importance except the ionizing property of the rays and their exact nature. The ionizing property was discovered by J. J. Thomson and Rutherford (later Sir Joseph Thomson and Lord Rutherford) within twelve months, and was published in 1896 in a paper on "X rays and Electrified Air." In regard to their nature, Roentgen expressed himself definitely in favour of a wave motion of the ether similar to that of light — although he suspected a longitudinal wave motion rather than a transverse. For several years this opinion went unheeded and

the belief that X rays are corpuscular was general, till Lauè in 1912 demonstrated interference phenomena in a crystal and so established the fact that X rays and light are alike in wave motion, but differ in wavelength.

So much then for the word of him whose discovery gave rise to your Society, and made possible the labours of Stanley Melville. Roentgen himself in his paper admits that he is building on what has already been done — that he is weaving a bit more into the pattern of human knowledge— leaving it to his successors to carry on. It in no way detracts from the glory of this or any other discovery to point to the team work spread sometimes over centuries, which is necessary before the event can happen. Roentgen mentions that he was working with a Crookes' tube energized by a Ruhmkorff coil.

It would obviously take us too far to explore these two achievements backwards into the ramifications of history, but it will be interesting to note a few of the milestones. In the first place Roentgen was using a Crookes' tube — a tube designed by Sir William Crookes here to investigate the passage of electricity through gases. During his work Crookes came within a hair's-breadth of the discovery of X rays himself — but missed them. All such work would have been impossible if other investigators had not shown us how to produce a vacuum — and their number is great — and how to produce electrical tensions which can cause a current to flow through a vacuum, and the number of the latter is even greater.

First in time is Gericke — mayor of Magdeburg during the thirty years' war. For twenty years he experimented, and having first made a pump as tall as a two-storey house, he came down to one of reasonable dimensions. His chief object was to prove how great is the pressure of the atmosphere around us, and this he did by constructing a hollow copper sphere in two halves — called the Magdeburg hemispheres. They fitted together in air-tight fashion and he then pumped out the air. After this he attempted to pull them apart, but found that two teams of eight horses could only just do the job.

Gericke's pump was improved by Robert Boyle, and Hooke, and Hawksbee here, and then by others in France and elsewhere. By itself it could not give us the vacua which are necessary for X-ray work to-day, but Gaede and Longmuir came to help with what is known as the mercury diffusion pump. In this a stream of mercury is driven past the opening of the vessel to be evacuated and which contains the small number of molecules of air which are to be taken out. Every so often one or more of these molecules strays out into the stream of heavy mercury molecules, which rush past the opening and is hustled away by them, till there are very few left and an almost complete vacuum exists. Three hundred years went by between Gericke's experiments and Roentgen's discovery, but without the former the latter would have been impossible.

On the electrical side, the Ruhmkorff coil which Roentgen used was the direct outcome of the experimental work of Faraday, who, in establishing the laws of induction, not only made

the coil and the transformer possible, but indeed laid the foundation of all electrical engineering. Ruhmkorff was a scientific instrument maker in Paris, and made his induction coil in 1851. Faraday was an experimental physicist. It is related of him that he once said in jest that his only contact with mathematics was when he turned the handle of a simple computing machine. In fact, it is on record that he wrote to Clerk Maxwell — one of our greatest mathematical physicists — as follows:

> "When a mathematician engaged in investigating physical actions and results has arrived at his own conclusions, may they not be expessed in common language as fully, clearly, and definitely as in mathematical formulae? If so would it not be a great boon to such as we to express them so — translating them out of their hieroglyphics that we also might work on them by experiment?"

Faraday by his experiments did even more than to lay the foundation of electrical engineering. He put into the hands of Clerk Maxwell experimental data from which Maxwell was able to build up his electromagnetic theory of light which has explained much of the nature of light, and in recent years, of X rays.

I cannot pursue the electrical side further back, but I would like to show you the picture of one man to whom you owe any sorrows which you may have in connection with voltage drops. George Ohm, born in 1789, and sometime Professor of Physics at Erlangen, in Bavaria, first published his law in 1826, but he did not find the universal fame and respect due to him for so fundamental a discovery till our Royal Society awarded him the Coply Medal in 1841.

I have mentioned these names to emphasize the point that the discovery of X rays — as indeed any discovery — is the work of a line of individuals moving forward step by step — a journey on which every now and again one step is of significant importance, but in which no such step can be made without the others which went before. Professor Silvanus Thompson said:

> "In the history of science nothing is more true than that the discoverer, even the greatest discoverer, is but the descendant of his scientific forefathers; he is always essentially the product of the age in which he is born."

To use an electrical expression, we might call this process "team work in series." Now the application of X rays to medicine, which we call radiology, is carried out by several individuals working together — "team work in parellel." The team as we know consists of the radiologist, diagnosing, directing, and generally in supreme control; the physicist, who is chiefly concerned with measurements — and the radiographer, who makes the pictures and often conducts the screen examinations. Somewhere in the background there is that lowly organism which we call the engineer, who makes the equipment and attends to its ailments. For our present purpose we take no notice of him.

Much, very much, of the success of an X-ray department depends on the radiographers — and it is for this reason that Stanley Melville became so interested in their Society and training — and it is here that I would in all humility, offer a few remarks. In approaching this subject I am mindful of two sayings in our language. The first is: You should know everything of something and something of everything. And the second: You should not be a Jack-of-all-trades and master of none. There are in your Society some 2,000 members, and the overwhelming majority is engaged on the diagnostic side of radiology. The education of the radiographer must therefore be directed primarily towards this end, with

therapy as a special subject when needed.

Now what is the ultimate object which the diagnostic radiographers have in view? Clearly it is the production of a film negative or the fluorescent screen picture or both. To achieve this they must handle the film, the darkroom, the patient, and the electrical equipment. Science, that is to say, exact rules govern their work on the film, the darkroom, and the electrical equipment. In the handling of the patient science plays a smaller part. Here we find art, if by art we mean that skill and craftsmanship whereby an individual achieves great results when working with ever-changing material, each case having to be dealt with individually. The fundamental scientific subjects then, of which the radiographer must have fulsome knowledge, are the handling of the film and the care of the darkroom. Immediately after these come the knowledge of anatomy and, as Dr. Kerley recently emphasized, pathology. A training in these two subjects in so far as they enter into the field of radiography is evidently necessary to enable the radiographer to become an artist in handling the patient.

So much then for the something of which the radiographer must know everything. It is already a formidable programme of knowledge. I come now to the everything of which he or she must know something. You will find that this of necessity constitutes an even more formidable programme, but one which, in my submission, you will do well to watch lest peradventure it becomes unwieldy. First on the list is the electrical equipment. It is evident that our student must know much about this. He or she must have a general idea of its anatomy and pathology, of the way it works and how to handle it, but I ask you to note one thing. All of us use watches and clocks day in and day out. Many of us drive motor-cars. In the majority of cases we keep our appointments quite satisfactorily when we have learned how to use a watch without knowing much about its internal construction, still less being able to make or repair one. And, provided we have learned to drive a car and have studied the highway code — obtainable at any post office — and a few odds and ends, such as filling up petrol and water, and changing a wheel, or freeing a locked self-starter, we can proceed quite satisfactorily in our car from one place to another without being conversant with the theory of internal combustion engines or the practice of their design, construction, and repair. Unquestionably we become better and better citizens the more we acquire in the way of knowledge and craft, and if we can add to our accomplishments the knowledge of design and making and repairing of watches and cars, that is eminently desirable. But if the learning of these things prevents us from becoming really efficient at that other job for which we read the time, or to which we go by car — the result is not so good.

So I come to my point that in arranging the course of study for future radiographers you must avoid overloading the syllabus. You must keep your eyes firmly fixed on the fundamental — the negative, the darkroom, the handling of the patient, his anatomy and pathology, and as much of the handling of the equipment as is necessary to enable them to carry out their work. You do not want to make engineers of them, not because they would not make good engineers — far from it. Quite likely they would be

better engineers than those we now have, but I submit that in becoming engineers they might cease to be radiographers simply because when you are a Jack-of-all-trades you are master of none.

You will observe that so far there is one word which I have not mentioned. namely, physics. I have left it to the end because it is the biggest subject of all — and the most fundamental. It is my belief that the time is not far distant when a knowledge of the way in which the material world around us works — which is physics — will be a prerequisite before anybody can call him or herself cultured and educated. That does not mean that those who have anything to do with the teaching of physics or engineering should now experience an incipient swelling of the head at the thought of being or becoming high priests of a scientifically minded humanity. Let us rather reflect in all humility on what we mean by physics and how best to impart that knowledge.

"Physics," as your late president, Dr. Kaye, once said to me when we were discussing this very subject of radiological training," "is the knowledge and understanding of the material world around us. It is the explanation of how anything which we observe to happen in the world works." Physics does not explain why things work. That is the domain of philosophy. Reduced to its simplest definition, physics is the knowledge of the phenomena of the action and interaction of matter and energy and the laws to which they conform. A moment's thought will tell us that such laws govern not only the behaviour of the electrical equipment or the properties of X rays. They underlie the study of anatomy and pathology, they enter into the treatment of the film. They continually crop up in the darkroom. They underlie every branch of science, both known and to come.

There is a tendency to-day to speak of many different kinds of physics. We have biophysics, astrophysics, radiation physics, atomic physics, molecular physics, and so on. It is, I think, a regrettable tendency, for, whilst the several names mean the specialized fringes of physics in those particular spheres, they somewhat hide the fact that the general science of physics is common and fundamental to them all. Moreover, the human body is nothing more or less than the most perfect engine that we can imagine. There is hardly a machine or instrument which we humans construct of steel or copper, glass or insulating material for pumping, seeing, hearing, electrical conduction, and the like, which does not find its counterpart in the human body — but with this difference. Man-made engines and instruments are, in the main, constructed from materials of high atomic number and great strength. There is, as we say, a considerable factor of safety. In the human body their counterparts are made of hydrogen, carbon, nitrogen, and oxygen, with trifling additions of heavier elements. The laws which govern their functioning are much the same, but the factor of safety, the tolerances as we say, are much finer. The doctor is nothing more or less than a super-engineer, and his assistant in what are known as the auxiliary medical services — the radiographers, the hospital nurse, and so on, are, correspondingly, the same. And all of them must have a broad basis of knowledge of how things work in the world of matter and energy.

Now the explanation of how things work need not take the form of a string of mathematical formulae and equations, comprehensible only to the few who are initiated. There is no more need for this than there is for the ancient hieroglyphics which used to adorn the doctor's prescription. The explanation should be in the King's English, comprehensible to all who can read and write and are intelligent.

Faraday, in his letter to Clerk Maxwell which I quoted to you, did not say, "Would that I were a mathematician so that I could understand what you fellows are talking about." What he did say in effect was, "Cannot you people express in plain English the deductions which you now clothe in mathematical language?" Mathematics is one of the most beautiful disciplines of which the human mind is capable. It is a never-ending joy to him who has a liking for it. In the hands of the physicist it is a form of shorthand whereby he can put his thoughts to paper and develop them, and also communicate them to others similarly equipped. But mathematics cannot replace plain English in explaining phenomena to those who are learning how things work.

In the early part of this year there was in The Times a correspondence which seems to take place at fairly regular intervals on the advantages or otherwise of a classical education. The writer of one of the letters quoted an eminent divine of Victorian vintage as saying that a study of the classics is advantageous because it equips us with a healthy and altogether desirable contempt for those who have not learned Greek and Latin. Let it never be said of the knowledge of mathematics that it serves the purpose of raising the self respect of those who have it over those who have not.

But to return to physics and the radiographer — I see a danger of the instruction in this subject becoming too specialized. There is a danger that your radiographer students of the future may be depended on, at examination time, to recite whole paragraphs about the electron, proton. neutron, positron, deutron, photon, cyclotron, betatron, and so on — with the atom bomb and voltage-drop thrown in; that he or she will be able to sketch out wiring diagrams of one-, two-, four-, and six-valve units, with Greinacher and Villard added, without a really clear idea of what they are talking about. And in recent examinations we see the beginnings of mathematical questions — quite simple ones, no larger than a man's hand, but of a kind which foretell the coming tornado. Now this is all very well if you are sure that such knowledge is founded on a wide understanding of the general behaviour of matter and energy. If not, then it is merely information acquired parrot-like and forgotten immediately after the examination.

My submission is that the physics which a radiographer student is taught should be qualitative rather than quantitative. There should be the least possible amount of mathematics about it and it should cover a wide field rather than a deep one. More especially the phenomena to which the radiographer is introduced should be related to and explained in terms of those which he can observe around him. To give you an example — let us suppose that you are preparing for Part I, and that we have reached the point where we must explain the scattering of X rays. It can be done in two ways. We can say that X rays of an intensity I-o reach the body and enter it. On leaving,

their intensity is reduced to Id where d is the thickness of the body and the difference in the two intensities is due to the fact that some of the radiation has been totally absorbed in the body and another portion has been scattered by the electrons which it has encountered — the whole phenomenon being represented by the equation

$$I\text{-}d = Io\ e\text{-}ud$$

where is the coefficient of absorption and scatter and depends on the wavelength.

We can explain it thus, but we could also describe it in the following way. Suppose you are by the sea-shore and there is a large rock some distance, say 100 yards, out. If the rock is large enough it will break up and scatter not only little waves having a small distance from crest to crest, but also the long Atlantic rollers where distance from crest to crest is great. Next suppose that our rock could grow smaller. There would come a time when it would still scatter the little waves of short wavelength — but those whose distance from crest to crest is great would roll over or round it and form up again on the other side and reach the shore. Such similes are apt to limp a bit, but they give us a kind of mental picture which is useful.

Now, may it be that visible light which consists of a range of wavelengths represented by the number 7000 for red, down to 4000 for blue, would show a similar selective scattering if particles of a suitable size like our rock were put in its path. Here we would show them the experiment first devised by Professor John Tyndall, and repeated by Professor Andrade at the Royal Institution Christmas lectures two years ago, in which a cylindrical beam of white light passes through a tank of water and produces a disc of white on a screen beyond. When we put particles of Jeyes' fluid in suspension in the water, the beam which was almost invisible before becomes visible with a bluish milkiness, whilst the disc on the screen beyond changes from white to red. And as we increase the number of particles in suspension in the water, so the bluish tinge to the milkiness moves towards the end of the tank where the light enters, whilst at the other or screen end there is a more reddish tinge. The whole experiment shows that out of the collection of wavelengths of which white light consists. the short or blue ones are more readily scattered than the long or red ones. Hence also the blue colour of the sky. In X rays the phenomena are similar, only the dimensions are different. Instead of particles of colloidal size, as in our experiment, the electrons of the atoms do the scattering, but the rule that short wave-lengths are scattered more than long ones still holds. Then we would insert this honeycomb diaphragm between the tank and the screen and show them that its effect is to eliminate completely the white or bluish coloration from the whole of the screen. And they would see that the patch of red light again becomes clear and well defined, whereas it had become blurred and indistinct when the screen was moved up to the tank and the bluish glare from the water had been superimposed. This then gives them a demonstration in terms of white light of what is scattering and of how the Potter-Bucky diaphragm works.

Do we tell the radiographer students these things, and do we tell them that the energy of the flying electron raises the temperature of the focus in accordance with the phenomenon of specific heat, and that we remove that heat by

using the phenomenon of conduction and radiation? And do we explain that the same set of phenomena operate in the kettle, on the kitchen gas-stove at home, and what are the results? And do we tell them what is vapour pressure, and how in any liquid some particles of more than ordinary energy break through the surface to the space above? Such particles then roam around and could if bombarded by electrons be split up through ionization by collision. And that is why the bearings inside a rotating anode tube must be dry — since the vapour pressure of any oil would give rise to gassiness through ionization by collision — and that is why the anode may only rotate during the exposure, since any prolonged rotation wears out the bearings too soon. When we tell them that the sharpness or otherwise of the X-ray negative is connected with the fineness of the focus, do we add the whole phenomenon is related to what we observe during an eclipse of the sun or the moon?

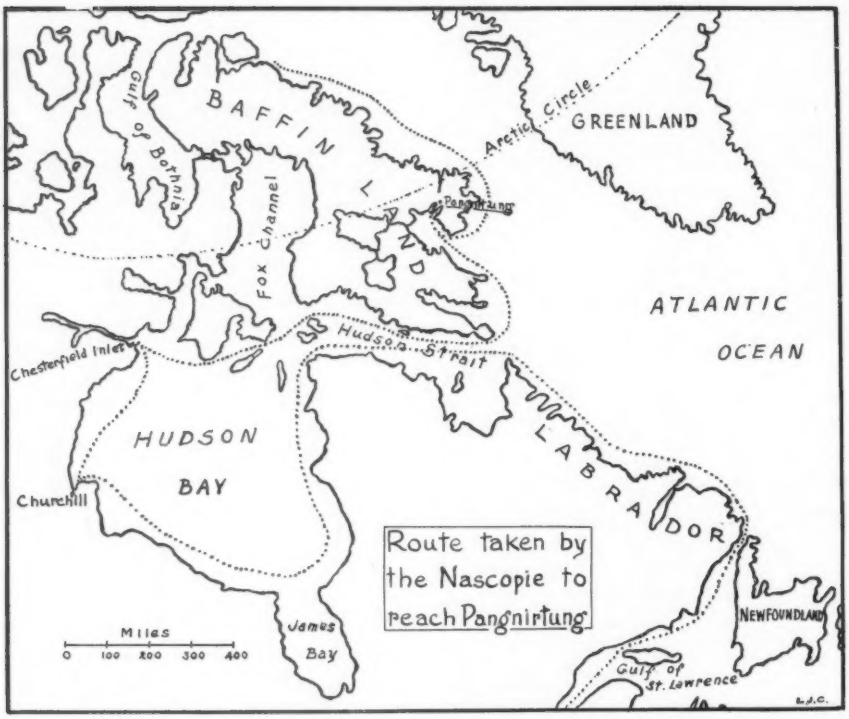
A host of examples might be quoted, especially of effects which are a daily occurrence to us but which when they occur in what we call X-ray physics wear some more or less terrifying name. If we take some care along these lines, the radiographer students will, I submit, have a clearer understanding of what is happening than if the subject is conveyed to them with many formulae as something which has little or no connection with what goes on in everyday experience.

May I quote Professor Tyndall — a successor to Faraday at the Royal Institution, when writing a life of that great man in 1870. He wrote that:

> "Faraday had heard it stated that henceforth physical discovery would be made solely by the aid of mathematics, that we had our data and needed only to work deductively. Statements of a similar character creep out from time to time in our own day. They arise from an imperfect acquaintance with the nature, present condition, and prospective values of the field of physical enquiry. The upshot of natural science will doubtless be to bring all physical phenomena under the dominion of mechanical laws; to give them, in other words, mathematical expression. But our approach to this result is asymptotic: (I prefer the word 'gradual') and for ages to come — possibly for all the ages of the human race — Nature will find room for both the philosophic experimenter and the mathematician."

To sum up, may I plead that the radiographer be taught experimental, or as one might say, qualitative or descriptive physics on the broadest possible basis, rather than mathematical or quantitative physics on a narrow front — that we should take as our examples those giants of the Victorian age, Faraday, Tyndall, Huxley, Silvanus Thompson, and others, and that we should put the newer knowledge which we have to impart into the forms which they would have given to it. By describing phenomena, rather than by stressing their algebraic symbolisms, we shall ensure that students will understand what they do and what is happening rather than carry out their work by rule — not knowing why. Let us not presuppose a knowledge of how things work and plunge into putting down formulae or calculating and measuring.

By watching for pitfalls in these directions we will add much to that educational structure which we are still building on the foundations so well and truly laid by him whose memory we honour to-day—Dr. Stanley Melville.



X-Ray Comes to the Eastern Arctic

By E. PRUDENCE HOCKIN, R.N.
Pangnirtung, Baffin Land

I FIRST went to the Arctic in 1931 but anyone making the trip in 1946 will travel in by the same route. One goes by train to Churchill, Man., and there the Hudson Bay Company ship R.M.S. Nascopie will be taking on her second cargo for the Northern part of her voyage. The Nascopie leaves Montreal early in July of each year and proceeds north along the Labrador coast, through Hudson Straits and down the east coast of Hudson Bay, calling at all the Company Trading Posts along the way leaving supplies for them, for the Missions and for the Royal Canadian Mounted Police. At the same time, of course, she picks up a valuable cargo of furs to be taken cut to the fur markets of the world.

Churchill is usually reached four to six weeks after leaving Montreal, depending on the ice conditions which vary from year to year and also depending on the amount of fog encountered. Leaving Churchill the Nascopie turns north up the west side of Hudson Bay, calling at Chesterfield Inlet, then

Miss Hockin is a Graduate of The Children's Hospital, Winnipeg. She has been at Pangnirtung, Baffin Land, for ten years working under the Diocese of the Arctic of the Anglican Church, and is now back on eight months' furlough.

east to call at Southampton Island before again going through the Hudson Straits. Once through the Straits she steams straight north around the northern end of Baffin Land to Fort Ross. This is the most difficult post to reach and for two years in succession recently the ice conditions were such that the Nascopie, stout ice-breaker though she is, could not force herself through and had to turn back. Next the Posts on the northern part of Baffin Land are visited and the Nascopie again turns south, calling at Pangnirtung which is on the east coast of Baffin Land about half way down and the last port of call. This is our destination and it has taken us approximately six weeks from Churchill. With one call on the Labrador coast the Nascopie will be again in Montreal in about 10 days, about three months from the time she left.

The Eskimo living on Baffin Land are a very primitive people and have been little touched by civilization. They still live entirely by hunting and trapping. They live in tents made out of seal skin and heated by seal oil lamps. Their clothing to a great extent is made of seal and caribou skin and their food consists largely of the meat of these two animals. In 1931 when the hospital was opened many of them had never even seen a white woman. The idea of a hospital was naturally very new to them and looked on with some suspicion. The first patients were only allowed to come because their people had decided they were going to die anyway so we could therefore do them no harm. Some of these patients made miraculous (to Eskimo minds) recoveries and so little by little our reputation was made.

Tuberculosis in every form is one of our major problems, although that has shown a marked improvement in the last ten years. Respiratory infections too are prevalent, especially after the annual visit of the ship. A severe epidemic of pneumonia in the fall of 1941 forced our 22-bed hospital to accommodate 41 patients. A number of cases of frost bite have been treated, varying in severity from quite mild cases to one young man whose one leg had to be amputated half way between the knee and ankle and the other foot amputated through the instep. This young man was very anxious to be up and around again after his operations so the Missionary made him an artificial leg and foot. This home made leg was rather heavy but it was amazing how quickly the Eskimo was able to use it and walk without crutches. He balanced very well with the half foot that was left. Later the doctor on the Nascopie took his measurements and the Government provided him with a "store made" artificial limb. With this aid he will be quite capable of earning his own livelihood.

There was great excitement in the small settlement at Pangnirtung when the electric light plant and x-ray apparatus arrived at the hospital. -This equipment was ordered by the Anglican Mission Office in Toronto and was sent in in 1932.

As soon as the supply ship left, work on the power house began. The small building was put up very quickly as everyone was eager to unpack the engine, x-ray, etc. When these cases were all opened the awful truth was known; we had a complete plant with all supplies for the x-ray, plates, cassettes, developer and fixer and not one

word of direction as to how to put it together or how to operate it when it was assembled.

The united efforts of all the men (every man in the Arctic is an engineer) put the engine together and made it run but wiring the engine to the generator to the control board was quite a different matter. Several unsuccessful attempts were made, one of which broke the ammeter so that problem was given up.

Meanwhile the doctor and the Missionary were working on the x-ray and finally by trying to place every piece in every possible position they found the one place each piece would fit. The fluoroscopic unit gave the most difficulty; it has a wooden screen on it which hangs in a vertical position; it was our ambition to fasten it horizontally and use it as a table.

The one book which contained any mention of x-ray was produced from one of the book shelves and studied. It repeatedly mentioned a spark gap which seemed most important and essential. We none of us knew just what it was or where it was to be found. The doctor finally decided it must be in the tube so he proceeded to take the tube apart in the hope of finding it. It was not there!

Mail at that time came in on the ship and went out on the same ship once a year only, so we had to wait until the next year to tell our troubles and one year more before we got the reply. However the Astronomer on the ship the first year knew something about electric plants and he drew up a plan of the wiring which proved to be correct and the plant minus the ammeter was put in operation.

Our troubles with the x-ray then began, as we none of us had any experience in that line . The first plates besides being over-exposed were a little over-developed as we left them in the solution for 20 minutes. After that we decided to treat the plates in the same manner as we did the films from our cameras regardless of what the encyclopedia said. The first plate that turned out to be of any value was our most prized possession; it was an infected finger and actually showed that the bone was in good condition. It was truly wonderful.

There was no dark room in the hospital and developing had to be done wherever it was possible to darken a room, the cassettes being loaded in the broom cupboard under the stairs which is always dark. The tank sent in for developing was much too large for the amount of work being done and also was made to be connected with running water which we have not.

Finally after three years we had everything in running order but in the meantime new machines had been put on the market and the chart with exposure techniques on it which we received did not correspond with our machine. We never did get the right one!

The X-Ray Department of the Royal Jubilee Hospital in Victoria have kindly undertaken to show me how x-ray work is done with the most modern equipment and strange to say I have never heard one of them mention that elusive spark gap!

Les Rayons Guérisseurs—et Meurtriers

Par H. LACHARITE, M.D.
Hopital Sainte Jeanne d'Arc, Montreal, Que.

Les Rayons-X:

Le 8 novembre, 1895, il y a de cela exactement un demi siècle, un physician bavarois, à la suite d'expériences poursuivies dans un laboratoire rudimentaire qu'il s'était monté à Wurtzburg, dota la science d'une des plus merveilleuses découvertes des temps modernes: les rayons-X.

A l'instar de ses prédécesseurs, Wilhelm Conrad Roentgen avait observé la luminescence de certains gaz sous le passage de courants électriques dans les tubes à vides. Il avait constaté la richesse et la variété des couleurs engendrées dans l'azote, et les avait vues, de même que les teintes particulières à l'hydrogène et à l'oxygène, se modifier selon le degré de raréfaction atmosphérique.

Ce jour-là, Roentgen recouvrit délibérément son tube de Crookes d'un masque opaque de carton noir, et fit l'obscurité avant d'exciter le tube au moyen d'une bobine de Ruhmkorff. Sur un banc dans les environs, se trouvait un morceau de papier enduit de platino-cyanure de baryum. Le tube à vide, soumis à un courant inducteur, était dissimulé sous le carton noir. Quel phénomène cette expérience allait-elle révéler?

Comme le courant circulait dans le tube, Roentgen aperçut à travers l'obscurité une mystérieuse lumière verdâtre que s'était dessinée sur la feuille de papier. Le platino-cyanure de baryum était devenu luminescent sous l'action d'une irradiation invisible. Toute autre source de lumière ayant été supprimée, les rayons provensient nécessairement du tube de Crookes. Quel était l'inconnu? Roentgen l'ignorait et c'est pourquoi, suivant l'usage, il lui accola un "X". Cette appellation lui est d'ailleurs restée.

A cet instant historique, l'éclair du carton fluorescent forgesit un nouvel instrument de pénétration pour l'humanité. Ses rayons avaient traversé les parois de verre du tube de Crooks et l'enveloppe de carton qui le voilait. Le principe était posé. L'émission des rayons-X permettrait de tout pénétrer.

Pendant les 50 années qui suivirent la découverte des rayons-X, la radiographie s'est développée d'une façon étonnante. Elle s'est affirmée la collaboratrice inappréciable de la médécine dans le diagnostic et le traitement des maladies.

Cependant, les rayons-X ne sont plus l'apanage exclusif des la médecine, ils sont maintenant appelés à déceler bien d'autres choses que des fractures, des lésions pulmonsires et stomacales, ou l'épingle de sureté que le bébé vient d'avaler. L'industrie, et tout spécialement l'industrie lourde, les les emploie couramment. La petite ampoule et la bobine de Roentgen se sont métamorphosées en des tubes hautement mécanisés à anticathodes rotatives et en machines massives d'un débit qui dépasse parfois un million de volts. Que de progrès depuis l'ancienne plaque de verre jusqu'au type le plus récent de pellicules radiographiques. Les rayons-X n'ont pas fini leurs révélations, leur champ d'exploration, étant à vrai dire, illimité.

Le Radium:

Pour comprendre la genèse de cette autre merveilleuse découverte, il faut nous reporter à l'année 1896, un an suparavant. La découverte de Roentgen avait bouleversé tout un chapitre de la physique et suscité parmi les savants du monde entier, une vive émulation pour expliquer la nature de ces rayons qu'on commençait seulement à connaître de fait, sans pouvoir en élucider la genèse profonde. L'illustre mathématicien Pointcaré, cousin du Président Pointcaré, s'était demandé si ce n'était pas la fluorescence de l'ampoule par les rayons cathodiques venant frapper sa paroi (car à cette époque, l'anticathode métallique n'existait pas) qui serait la cause des rayons-X. Suivant cette hypothèse ingénieuse, mais fausse, une substance suffisamment fluorescente émettrait des rayons-X chaque fois qu'elle serait illuminée.

Becquerel eut alors l'idée d'illuminer par le soleil des cristaux fluorescents d'uranium déposée sur une plaque photographique enveloppée de papier noir, pensant que sous cette action, selon l'hypothèse de Pointcaré, des cristaux de surfate d'uranium émettraient des rayons-X et que, de ce fait, leur image apparaitrait sur la plaque après le développement. Ce qui eut lieu, mais en réalité non pour les raisons supposées.

En effet, une répétition de l'expérience ayant été préparée (avec quelques modifications sur lesquelles je passe) mais le soleil ne s'étant pas montré, le dispositif fut laissé au fond d'un tiroir obscur.

Au bout de plusieurs jours d'attente, Becquerel voulut vérifier la plaque à titre de témoin, avant d'en exposer une nouvelle au clair soleil.

A son grand étonnement, le plaque laissée dans l'obscurité dans un tiroir et recouverte de cristaux de sulfate d'uranium, avait été impressionnée. Les cristaux d'uranium émettraient donc d'eux-mêmes des rayons susceptibles d'impressionner les plaques photographiques et comme le démontra Becquerel, de décharger des corps électrisée, ils étaient, suivant le mot ultérieur de Mme. Curie, radio-actifs. Cette découverte capitale de Becquerel figure au compterendu de l'Académie des Sciences du 2 mars 1896 et inaugure l'ère de la radio-activité.

C'est alors que Mme. Curie se mit à l'oeuvre à l'Ecole de Physique et Chimie pour vérifier si la radio-activité était spéciale à l'uranium ou pouvait se rencontrer dans d'autres corps. Elle cherche alors à préciser quelle pouvait être la radio-activité de toute une série de corps. Elle le fit au moyen de la méthode électrique qui consisste à mesurer le courant de faible intensité traversant l'air rendu conducteur, ionisé par les rayons émanant du corps radio-actif. Cette mensuration fut possible grâce à l'extraordinaire sensibilité de l'admirable quartz piezo-électrique de Pierre Curie. Cette méthode qualifiée per Mme. Curie elle-même de "Chimie de l'Invisible" peut doser un milliardième de millimètre cube d'emanation de radium.

La précision de la méthode de mesure permit à Mme. Curie d'apporter une foi absolue à son experimentation malgré des résultats, en apparence, paradoxaux. Le paradoxe était que certains fragments de minerai impur, tel que la pechblende de Joachimsthal (oxyde d'uranium) se montraient trois fois plus radio-actifs, d'autres, tel que la chalcolithe (phosphate de cuivre et

d'urane), deux fois plus radio-actifs que l'uranium lui-même.

Mme. Curie n'hésita pas à interpréter ces faits comme prouvant l'existence dans le minerai, à l'état de faibles traces, d'un corps inconnu, excessivement radio-actif et différent de l'uranium. Pierre Curie joignit ses efforts à ceux de sa femme pour rechercher ce corps nouveau dont l'existence leur semblait scientifiquement démontrée.

Cette "marche à l'étoile" dura deux ans.

On vit passer dans la cour du laboratoire des milliers et des milliers de kilos de minerai. Or, à cette epoque, le radium que l'on trouvait dans un lot de minerai était de l'ordre d'un gramme pour 400,000 tonnes de minerai. Mais leur foi en la science est telle qu'ils cherchèrent encore, qu'ils trouvèrent: si bien qu'en 1898 était présente à l'Académie des Sciences: le radium.

En effet, en décembre, 1898, M. & Mme. Curie, aidés de M. C. Bemont, avaient isolé nettement un nouveau corps chimique semblable au baryum, mais prodigieusement radio-actif et auquel l'éminent physicien Demarcay reconnut dans la région de l'ultra-violet une raie spectroscopique nouvelle et jusque-là inconnue.

Donc on avait découvert le radium, on avait découvert un corps qui envoyait des rayons capables de traverser les corps opaques, le plomb n'arrêtant ses rayons que sur une épaisseur de 30 centimètres: ces rayons déchargeaient des corps électrisés, mais nous savons aujourd'hui que ces rayons font quelque chose de plus: ils guérissent le cancer.

Mais pourquoi guérissent-ils, comment guérissent-ils et comment eut-on l'idée de les appliquer en thérapeutique? C'est que le radium possède la propriété de détruire les tissus vivants. Le premier à qui, par accident, se révèle ce pouvoir insoupçonne est Henri Becquerel.

M. Becquerel, qui était un peu le parrain du radium, obtint de Mme. Curie un petit tube de radium, ce tube étant tout simplement en verre. Il le mit précisusement dans sa poche, le montrant avec joie à toutes les personnes qu'il recontrait. Or au bout d'un mois, il constata sur sa poitrine une brûlure assez marquée, lente à guérir. Cette observation fortuite est vérifiée par Pierre Curie. Délibérément, en savant soucieux de contrôle, Pierre Curie voulut se rendre compte sur lui-même du phénomène; il prit un tube de verre semblable avec la même quantité de radium et se l'applique sur le bras pendant dix heures. Après quelques jours, il vit apparaître au point d'application une douloureuse ulcération dont la guérison ne damanda pas moins de quatre mois.

Dans l'espoir que cette force mauvaise disciplinée deviendra une force bienfaisante, Pierre Curie et sa compagne confient quelque peu de la précieuse substance à un médecin de l'Hôpital St. Louis, qui, avec précaution, l'applique à détruire diverses productions morbides de la peau. D'autres médecins français poursuivent ces premières tentatives de traitement, les étendant à des lésions plus profondes en réglant et en améliorant la technique. Ainsi naît en France en 1902 une médication nouvelle, bientôt adoptée, étudiée dans tous les pays civilisés et qui progressivement développe sa puissance.

La nouvelle méthode de traitement s'appelle d'abord la radiumthérapie,

puis après que d'autres substances radio-actives sont découvertes et que plusieurs se révèlent aussi des agents de guérison, elle reçoit le nom de Curiethérapie, qui lui revient aussi justement que, en Allemagne, celui de Roentgenthérapie appartient aux traitements a l'aide des rayons-X découverts par le physicien Roentgen.

Ce corps extraordinaire qu'est le radium, corps qui constamment émet des rayons de lui-même, comment les émet-il? Il émet une véritable lumière invisible, comme le soleil émet de la lumière visible. Mais le radium en émettant ses rayons se détruit; il ne se détruit pas vite car il ne perd la moitié de son pouvoir qu'en 1700 ans. Pour nous, cette période nous semble très longue, mais au regard de la science, c'est peu, puisque l'uranium, qui perd aussi son pouvoir, n'en perd la moitié qu'au bout de 6 milliards d'années.

Voyons maintenant d'un peu plus près ce qu'on nomme les rayons du radium. Ces rayons que l'étude des physiciens a permis de diviser en trois classes, les rayons Alpha, les rayons Beta et les rayons Gamma, désignés par les trois premières lettres de l'alphabet grec, ont été ainsi dénommés par Rutherford; ils ne sont pas tous directement émis par le radium. Une partie seule des rayons Alpha se trouve dans ce cas. Les autres sont émis par les produits de désintégration du radium, et par suite de cette désintégration; les corps radio-actifs sont en effet en état de perpétuelle désintégration, ou plus exactement de véritables transmutations avec dislocation de leurs atomes; ces phénomènes se produisent régulièrement, automatiquement, suivant des lois immuables, maintenant bien connues, et ne pouvant être nullement modifiées par l'action de forces extérieures.

Quand du radium dans un tube "scellé" à l'état d'équilibre (nous verrons dans un instant ce que constitue cet état obtenu environ un mois après l'emprisonnement du radium dans un tube bien scellé) émet des rayons Alpha, Beta et Gamma, une partie des rayons, et tous les rayons Gamma en particulier, prouviennent de la désintégration des corps eux-mêmes dérivés du radium, à savoir, l'émanation du radium et des corps appelés radium, A, B, C, etc.

Voyons d'abord ce que sont les rayons Alpha, Beta et Gamma, nous verrons ensuite leur genèse.

Les rayons Alpha sont des atomes d'helium, chargés positivement et lancés avec une vitesse de l'ordre de 20,000 kilomètres par seconde, mais qui ne peuvent parcourir plus de 7 centimètres et sont arrêtés par le moindre obstacle. Ils ne peuvent franchir 0 m/m .06 d'aluminium et sont arrêtés par la couche toute superficielle de la peau; ils sont facilement déviés par des champs magnétiques comme des corps positifs, c'est-à-dire, en sens opposé de la 2ème. classe des rayons du radium, les rayons Beta, qui, eux, sont des corpuscules négatifs. Ces rayons se comportent ainsi comme les rayons canaux de l'ampoule de Crookes auxquels ils sont analogues. Ils sont peu utilisés en thérapeutique et uniquement dans les applications d'émaux radio-actifs. Ils représentent environ 91% de l'énergie du radium.

Les rayons Beta sont tout-à-fait analogues aux rayons cathodiques de l'ampoule de Crookes et comme eux, fortement dévies par le champ magnétique comme les corpuscules négatifs,

c'est-à-dire, des grains d'électricité chargés négativement, projetés avec une vitesse qui peut être voisine de celle de la lumière. Ils représentent 3.2% de l'énergie totale du radium.

Les rayons Gamma découverts par Villard représentant 4.8 de l'énergie du radium ne sont pas comme les précédents des rayons corpusculaires, mais des rayons vibratoires. Ils ne sont donc pas deviés par le champ magnétique et sont comme eux, de nature ondulatoire, mais de beaucoup plus courtes longueur d'onde que les rayons-X les plus durs, même ceux émis sous 200 kilovolts. Ce sont proprement les rayons Gamma qui sont employés en thérapeutique. Dans quelques cas et en suivant alors une technique spéciale, des rayons Beta sont aussi utilisés.

La Curiethérapie utilise tantôt l'action générale des substances radioactives introduites par diverses voies, à l'état de dilution extrême dans la circulation sanguine, tantôt et beaucoup plus souvent l'action locale exercée par le rayonnement de ces substances dont le radium reste le type le plus parfait. Cette action locale trouve son emploi bienfaisant dans un assez grand nombre de maladies différantes dont sans doute la liste n'est pas close.

Entre ces maladies, le cancer, par sa gravité, occupe le premier plan et laisse dans l'ombre toutes les autres. Comment dont agit sur ce fléau, le rayonnement du radium? Comprendre son mode d'action sur les tumeurs cancéreuses, c'est comprendre aussi son efficacité contre d'autres tumeurs et dans d'autres maladies moins graves.

Rayons-X et rayons Gamma sont de même nature. Ensemble ils possèdent avec la propriéte de traverser tous les corps, celle de détruire individuellement à certaines doses les cellules vivantes. Les rayons Gamma joignent à l'avantage d'être beaucoup plus pénétrants, celui de se plier beaucoup mieux aux exigences très diverses du traitement. Le soleil en miniature que représente la moindre parcelle de radium se laisse enfermer en de petits tubes ou en de fines aiguilles de métal comparables à des ampoules de Roentgen Lilliputiennes. Ces tubes peuvent être répartis en plus ou moins grand nombre à faible distance de la peau ou bien être introduite à l'intérieur des cavités naturelles. On peut faire pénétrer ces aiguilles et les disséminer également dans d'épaisseur même des tissus malades. Ce sont autent de foyers minuscules mais merveilleusement actifs et puissants d'où rayonne en tous sens un feu invisible.

Dans ces tubes et dans ces aigulles, on peut aussi, à la place du radium enfermer seulement la substance gazeuse ou émanation, qui, par voie de désintégration atomique, s'en dégage sans cesse pour produire elle-même le rayonnement. Les foyers radio-actifs formes par cette émanation captée isolément ne représentent plus un capital immuable à revenu constant, mais seulement lerevenu périssable de ce capital, revenu d'ailleurs assez rapidement dissipé, puisqu'en moins de 4 jours, exactement 3.85 jours, il perd régulièrement la moitié de sa valeur. Son emploi n'en présente pas moins un certain avantage.

Les rayons-X et les rayons Gamma sont capables à fortes doses de détruire en masse les tissus vivants comme le ferait un caustique, mais, à moindres doses, il semble qu'ils fassent un choix; qu'ils exercent ce qu'on appelle une action élective, puisque parmi les diverses cellules vivantes du territoire irradié, ils tuent les unes et laissent les autres

intactes. A vrai dire, ils ne font aucun choix, mais nos diverses cellules épidermiques, musculaires, nerveuses, sont très inégalement sensibles à leur action destructive. La réaction de ces diverses cellules pour une même dose de rayons est aussi différente que dans la flamme d'un incendie pour une même température, celle des diverses substances, papiers, tentures, boiseries et métaux.

Les cellules vivantes les plus radiosensibles sont, en règle très générale, celles dont la multiplication est le plus rapide. Tel est le cas habituel des cellules cancéreuses. Telle est par suite la raison principale de leur plus grande radio-sensibilité. C'est ainsi que rayons X et rayons Gamma représentent autant de bistouris ou plutôt de flèches invisibles, merveilleusement subtiles et acérées, capables de cribler toute la région malade, de la transpercer et sans effusion de sang, sans mutilation, au travers de la peau intacte, de tuer, dans un organe profond, les cellules cancéreuses, tout en laissant vivre les cellules avoisinantes.

Les diverses chances de succès du traitement, les difficultés souvent insurmontables de son application, ses dangers indéniables, dépendent essentiellement du degré de l'écart entre la radiosensibilité des cellules cancéreuses et celle des cellules saines. Or, cet écart, parfois très grand, est assez souvent minimé et peut même devenir nul. Telle est, sans parler d'autres obstacles, la plus grosse pierre d'achoppement du traitement par les radiations pénétrantes.

Le radium n'est pas un talisman ni une panacée, applicable à tous les cancers et capable de guérir un cancer à toutes les périodes de son évolution. C'est seulement, en certaines conditions, une arme excellente et le domaine de ses applications s'étend à mesure que se perfectionne la technique très délicate de son emploi.

Le cancer n'a encore d'ailleurs livré qu'une partie de ses secrets, mais il n'est plus permis d'y voir un mal fatalement héréditaire dont l'apparition et l'évolution seraient également fatales, auquel on devrait religieusement ou stoiquement se résigner. C'est à son début un mal local, étroitement et exclusivement local, né en un point de la multiplication anormale, désordonnée, anarchique de quelques cellules microscopiques sous l'influence de causes provocatrices diverses dont avec succès, dans les laboratoires de recherches, on poursuit actuellement sur les animaux l'étude expérimentale. A cette première période de mal local, il est certain que la cancer est curable, parfaitement curable. La condition nécesraire et suffisante pour la guérison, c'est la suppression ou la destruction complète de toutes les cellules cancéreuses encore assemblées dans leur foyer d'origine ou déjà en voie de dissémination dans le voisinage.

Pendant très longtemps, on ne connut qu'une seule amre au cancer: le bistouri du chirurgien. Mais depuis longtemps également, le bistouri cède le pas aux rayons-X et plus encore au radium dans le traitement des cancers superficiels, spécialement de la face et des lèvres. En ces dernières années ce sont des cancers plus profonds, plus rapidement graves et d'un traitement beaucoup plus difficile que le radium, à l'aide d'une technique meilleure, dispute avec avantage au bistouri.

C'est le cancer de la langue et de la bouche, celui de la gorge, celui du

larynx et le plus déplorable de tous, ce cancer du col utorin qui, lorsqu'il atteint la mère de famille, semble une cruelle rançon de la maternité et pour lequel surtout on serait tenté d'accouser la nature d'injustice, si on ne sevait que ses lois inflexibles ignorent le bien et le mal.

Pour cette série de cancers, dans les ces inopérables, on obtient du radium bien manié, non seulement de remarquables améliorations, l'allègement des souffrances et la prolongation de l'existence des malades, mais, avec une heureuse proportion, des guérisons persistantes. Dans les cas opérables, d'après les plus récentes et les plus probantes observations, les guérisons que donne le radium surpassent de beaucoup celles qu'on obtient avec le bistouri.

Autrefois, le médecin devant une tumeur cancéruse avait à se demander seulement: est-elle ou n'est-elle pas opérable? Il doit aujourd'hui se poser des questions plus complexes. Des deux armes, bistouri et radiations qui forment tout notre arsenal contre le cancer, laquelle est à preférer? Faut-il en employer une seule ou les associer? En ce cas comment vaut-il mieux combiner leur emploi? Problème difficile dont la solution diffèrera sans doute encore dans quelques années de ce qu'elle est aujourd'hui et dont l'étude laborieuse réclame des recherches constantes.

Il y a, à répandre ces notions, un intérêt capital et c'est pour cela que je suis heureux d'avoir pu exposer à cette assistance de collaborateurs et collaboratrices le problême de la lutte contre le cancer, grâce à vos grands patrons Roentgen et les Curie.

J'espère que vous irez tous et toutes répandre partout la bonne nonvelle et nous aider ainsi dans notre effort qui doit tendre à l'extinction de ce terrible fléau.

Quelques conseils pour terminer.

Je sais que vous êtes tous d'excellents techniciens radiographiquement et que vous pouvez même en montrer à la plupart des radiologistes, cependant, je vous engage fortement à agrandir votre champ d'action pour collaborer aussi efficacement que possible avec le radiothérapeute dans l'administration des traitements Roentgen et Curiethérapiques. J'ai le plaisir de vous dire à ce sujet que je suis très bien partagé. Votre collègue, actuellement en charge dans mon service, est un bel exemple de la technicienne complète et consommée et je profite de cette occasion qui, d'ailleurs, nous vaut le privilège de vous recevoir, pour la féliciter de ses récente succès. Sa compétence n'a d'égale que son dévouement inlassable. Son activité débordante en faissait récemment une victime de la rare "fracture de marche" en vrai soldat de la radiologie. J'ai nommé Soeur Marie-Francoise des Rayons-X, comme on l'appelle ici.

Mon dernier mot sera un appel à la prudence. Vous connaissez le danger des rayons. Ces mêmes rayons guérisseurs sont aussi des rayons mortels, meurtriers. La liste des victimes s'allonge constamment. Les Bergonié, Turchini, Blanche, que j'avais l'occasion de traiter à Paris et qui meurent néanmoins du cancer des radiologistes. Plus récemment, c'est Parizeau à Montrèal et Iser Salomon à Paris, qui sont victimes du cancer de l'intestin, tout comme Roentgen, est-ce coincidence ou l'effet des rayons?

Et Mme. Curie, emportée par l'anémie des radiologistes, quelque quarante années après sa découverte. Dans son laboratoire ou j'avais le privilège de travailler pendant plus de trois ans, on pouvait déjà soupçonner dès 1925 les premières atteintes de cette maladie qui ne pardonne pas. Elle ne veut pas cependant se rendre à l'évidence. Elle répond à la sollicitude de ses élèves en redoublant d'activité. Ce n'est que lorsqu'elle sent ses forces l'abandonner qu'elle se résigne au repos, mais il est trop tard. Ces dernières années, deux techniciens de l'Institut du Radium de Montréal, tous deux de la même famille, frère et soeur, étaient emportés par cette même maladie que l'on appelle l'anémie roentgenienne.

Ces faits doivent vous faire réfléchir et vous recommandent la prudence.

Que votre formue sanguine soit votre guide!

(In the July issue we will publish an English translation of this excellent article on X-Rays and Radium)

The Human Touch

By GEORGINA G. PHILLIPS, R.T.
Royal Edward Laurentian Hospital, Montreal

A WELL KNOWN radiologist has said that every technician should know how it feels to be placed in the various positions required for radiographs. In that way it would, or should, give the operator that "fellow feeling which makes us wondrous kind." In a children's school in the south of England they are taught the "human touch" in a very unusual way, and we may possibly term it extreme. To feel what it is like to be blind, they are blindfolded for a certain length of time, or taught to walk on crutches, etc.

I do not suppose one technician in a hundred has ever tried the sphenoid mouth position, or experienced the agony of having a plate pushed under a broken hip. To every sick person their own special disability is paramount and it is up to the technician to display interest and concern on their behalf. A nonchalant attitude and indifference to the patient as a suffering human, is all too frequent. Oftentimes a few kindly words will overcome irritability or actual fear and just as a good saleswoman is attentive to her customer, so we as technicians can give the patient a new angle on hospital contacts, making him feel he is among friends, not automatons working with dummies. I am sure we have all experienced the indifferent shop assistant with the lofty air who barely condescends to attend to our humble wants and how this attitude irritates us!

We, too, are servants of the public in a big way, so let us seek to cultivate those priceless qualities of sympathy and understanding, whose price is above rubies; it pays big dividends.

Fractures of the Extremities

and Problems of the Plaster Cast

By A. R. CHEFFINS

Ste. Anne's Hospital D.V.A., Ste. Anne de Bellevue, P.Q.

TO the average layman, fractures are just broken limbs. A broken arm, a broken leg — a crushed wrist or a dislocated finger. During these war years many people have become conversant with the term "fracture" through association with various first-aid classes — especially those provided by the St. John Ambulance Association — and have learned to think of and handle these broken limbs as fracture cases. They are taught that there are several kinds of fractures — in fact they usually consider fractures as under six headings, namely: Greenstick, Simple, Compound, Comminuted, Complicated and Impacted. That any one of these fractures can be of a serious nature they are well aware, and that as first-aiders they must render every care and do their utmost to prevent the possibility of further injury.

Upon admittance to hospital, however, the victim's injuries assume quite a different aspect. A diagnosis by the doctor admitting the patient informs us that the injury is a fracture of a special nature involving the Humerus, the Ulna or Radium, the Femur, Tibia or Fibula — possible fracture of the external or internal malleolus. Perhaps our requisition merely mentions a special term or name; for instance in the case of a wrist, suspected "Colle's", which is a fracture at the lower end of the radius and ulna, or suspected "Pott's", for fracture at the lower end of the tibia and fibula. Whatever terms are used. however the requisition is worded, the technician receives an image in his or her mind of the patient's injury, and a mode of procedure is suggested.

Dealing with the wrist as our first subject, the word "Colle's" would suggfest quite a different routine than if the word "scaphoid" was used. In the former (Colle's) the ordinary A.P. and lateral projections will usually suffice. Cardboard folders or screens may be used. In the latter case, that of injury to the scaphoid, the number of projections may depend upon the wishes of the radiologist. In our laboratory it is customary to make five views, using a 10 x 12 cardboard folder. Assuming the injury to be the right wrist, a true lateral view is made, taking up the extreme right-hand side of a 10 x 12 folder, placed longways, the unexposed portions being covered with lead shields. Then in top middle section of folder, the wrist is positioned for direct palmar projection. On lower middle section we position the wrist with hand inclined radially as far as possible. Moving now to the extreme left of the folder, in the upper section, we project an oblique view while the lower section we turn the wrist completely over and project a direct A.P. or dorso-palmar view. Our lead shields being moved around to cover those portions of film already exposed. For this purpose, a 10 x 12 cardboard folder may be ruled off in squares and specially kept for the purpose. Or a

10 x 12 cassette may be scribed into squares with an engraving tool. This simplifies the lining-up of the lead masks and makes for a more uniform picture.

Simple fractures of the radius and ulna call for simple routine — A.P. and lateral projections with central ray striking a point mid-way between the wrist and elbow will usually be all that is necessary. These two views may be made on one plate.

A fractured humerus calls for some thought on the part of the technician, depending upon the location of the injury. A fracture at the lower or elbow end may not be difficult to x-ray. The patient will sit at the end of the table, placing the extended arm out flat, palms uppermost. The cassette or cardboard folder being placed underneath, with site of injury in centre of field. For the lateral view, the arm is merely turned — turned completely from shoulder to wrist, with thumb up in true lateral position, humerus horizontally flat on table, cassette or folder again placed immediately beneath with site of injury in centre of field. Should, however, the injury be at the head or neck of humerus, the procedure is somewhat different. In this case the patient should lie supine on the table, with arm straight down by the side, and the central ray directed through head of humerus. The cassette may be placed immediately beneath the injured shoulder, or the Potter-Bucky diaphragm used. The lateral projection may be obtained in one or two ways — either by having the patient remain in supine position on table, arm outstretched with tube-arm lowered and tube tilted to horizontal position. Cassette is then placed behind the upper arm and central ray directed into the axilla. Another means of obtaining the lateral view, is to have the patient stand or sit, with arm outstretched. The cassette is placed above the shoulder and using the mobile unit, position the tube below and direct the central ray into the axilla. Care must be taken in placing the cassette. It must be positioned well over the shoulder towards the neck, otherwise, on account of the angle of the tube, the head of the humerus will be thrown too near the edge, possibly completely off the film.

So far, then, we have dealt with the upper limbs. Our patients have come to us, walking, and have been more or less able to accommodate themselves to our wishes. With the lower limbs, things will be different. Fracture of femur or lower leg involving the tibia and fibula, means the patient comes to the x-ray laboratory on a wheel-stretcher, possibly even in his bed. Whether the patient should be moved or not is the first consideration. If the injured limb is splinted, the matter is not so hard to decide. Rigid wood splinting, or a well-applied pillow splint, makes everything much easier. With the aid of the orderly, the patient may successfully manoeuvre himself, from the wheel-stretcher or his bed on to the table. Removal of splints depends upon the authority of the doctor in charge of the case. If he is present, he may remove the splints temporarily, otherwise the technician must procure the best "shots" he can through the splints, and with as little movement of patient as possible. The Thomas splint may cause some difficulties, on account of its metal braces, which invariably happen along the line of fracture. Oblique projections may then be necessary in

order to go "round" or underneath the metal braces. Assuming then, our patient has been duly admitted to hospital, examined by the receiving doctor and had the splints and dressing removed, he comes to the x-ray on his bed with pillows supporting the injured femur. With assistance and proper care this patient may be moved on to the x-ray table, the pillows still supporting the fractured limb. Using the Potter-Bucky diaphragm, an A.P. view can be made. It is advisable to process the A.P. film right away and from it, learn the location and nature of the fracture. It may be that further injury will be done should the patient be turned on his side for the lateral view. If the injured limb is on the side nearest the tube, then with the tube-arm lowered and swung around and the tube tilted to the horizontal position, a 10 x 12 cassette placed between the legs, vertical to table top, and at site of injury, the lateral view may be made. If the injured limb is on the side away from the tube, then the uninjured limb should be raised sufficiently to clear the port of entry and the horizontal ray directed towards the cassette held to the outside of the femur at the fracture site. It may happen that the patient is put to some pain by raising the uninjured leg. If such be the case, then the mobile unit must be brought into action and with cassette placed between the legs, the mobile tube set horizontally at the proper level and at the correct distance away, a lateral projection is quite easily procured.

Fractures of the tibia and fibula may be handled in a similar manner, though in most cases, with some assistance, the patient will be able to turn the injured leg without difficulty. The A.P. and lateral projections may be made on the same film, screens being used, and a lead shield used to cover portion of film not being exposed.

So far, then, we have considered the more or less simple fractures as we find them in most accidents. When we come to war casualties, the whole matter takes on quite a different aspect. The technician cannot now visualize the internal injury. The idea of a simple fracture is entirely "out." These limbs are shattered. Shattered by the spreading shrapnell from shell-fire, or splintered, by being pierced with machine-gun bullets. Fifty years ago, or even in World War I, many of these cases would have been amputation cases, but thanks to modern science, particularly chemo - therapy, these splintered bones and this torn flesh can be mended. Textbook positioning must be eliminated and routine projections in many instances are quite impossible. The plaster cast is the problem; not "getting through the cast," but the positioning gives cause for thought. For instance, a requisition was received in the laboratory for "Cervical Spine — Mastoid Areas and Temporo-Mandibular Joint." Quite an ordinary requisition, to be sure, but when the patient arrived at the laboratory with his head, neck and shoulders completely encased in plaster, with only a circular aperture for his eyes, nose and mouth, the whole not unlike a deep-sea diver's helmet, a real problem presented itself. However, the cervical projections were made without difficulty; the mastoids and temporomandibular joints were left undone.

The humerus presents the most difficult problem to the technician. There

are several types of fractures and many ways of positioning the injured arm in the cast. In practically every case, a complete body cast is utilized, thus the whole torso has to be manoeuvred when trying for "shots." If the arm is set downwards by the patient's side, with the forearm horizontal and strapped across the abdomen, the A.P. view may be made by having the patient stand with his back to the x-ray table raised to the vertical position and the tube horizontal, using the Potter-Bucky diaphragm. In the lateral view, turn the patient sideways to the table with injured humerus to table surface and the free or uninjured arm raised above the head. The "shot" is then made directly through the body. A good film may not be produced on the first exposure. Body thickness and several thicknesses of plaster cast may not quite coincide with the technique chart. Both MaS and K.V.P. will have to be increased considerably. A double exposure on a long exposure time with a low K.V.P. often produces a reasonably satisfactory result. Quite often the upper arm is set horizontally and in line with the shoulder — the forearm extended forward and angled towards the chest. Here the A.P. projection presents the difficulty, especially if the forearm happened to be in the same plane as the humerus. In fact, an A.P. is altogether out of the question and an oblique shot from below must suffice. The lateral view may be obtained by placing the cassette on top of the shoulder and the ray directed from below towards the site of injury. In this case, the patient may stand at end of table and the position of the tube changed accordingly. In another instance, the lower end of the humerus, near elbow joint, may be fractured. A full body cast again being employed with the upper arm angled slightly across the chest and the forearm strapped to opposite shoulder. A real problem is presented. Probably the best way here is to have the patient supine on the table and then slightly rotated towards the injured side. Place cassette underneath the humerus and angulate the tube in order that the central ray may strike across the shoulder and towards the flexed elbow joint. The other view may be made by placing cassette under the arm and between the chest, that is, if the arm is set sufficiently forward and the cast in the region of the axilla is not too thick, otherwise the patient may stand face to the table in the erect position and the ray directed horizontally through the back. The resulting pictures may not be of the best, but they will help a little when the doctors come to determine the nature of the injuries. It is not always easy to get perfect pictures of a fractured head of the humerus under the best circumstances, especially if the patient happens to be of very large and well-built proportions. Add to this a substantial body cast, and your problem is by no means minimized. In such cases the patient may be sat in a chair at the end of the table and with the tube horizontal and the tube arm being swung in several directions, a series of obliques across the body at front and back, can be made; an assistant holding the cassette to the body at the various angles. All this, of course, if you have plenty of room (such as we have), and your tube stand has plenty of travel beyond either end of the table. The mobile unit may also be used to advantage in such cases.

A fractured femur, especially the neck, when in a cast, presents its problems, too. Especially if your patient has both femora injured and is encased in plaster from the armpits to the ankles, and the legs probably spread-eagled, with a metal bar or stiff wooden wedge, also encased in plaster, set between the knees. With proper assistance, and using the bed-sheet as a sling, the patient may quite easily be transferred from bed to table. Taking A.P. views is routine, but laterals not so. On account of the brace-bar, a normal "shot" up into the groin is out of the question. However, by using a cardboard folder and bending it round the groin between it and the brace bar, and directing the ray at the correct angle horizontally down through the injured hip some sort of picture may be obtained. Don't expect to hit it right the first time. You probably will not. Here again, charts are not of much help. MaS and K.V.P. will have to be considerably increased, in order to penetrate the possible uneven thickness of the cast, and as the exposure factor cannot always be judged, several attempts may have to be made before a clear outline of the bone structure becomes visible. At any rate, due to the severe bending of the folder, any views thus obtained, are usually so distorted that they are really of little use to the radiologist or the doctor who has the case. A fracture at middle-third of femur, under similar circumstances may be x-rayed by this method, the cardboard folder being bent round between the groin and the brace-bar, with the centre field opposite the site of injury. However, there will still be distortion on account of the backward bend of the film surface, and views so obtained can hardly be considered satisfactory.

The tibia and fibula, when in plaster cast, do not usually present any difficulty. For more or less simple fractures, the cast extends from just above the knee to the ankle. Sometimes, in cases where the fracture occurs within the area of the lower third, the cast may combine the ankle and extend upward only to just below the knee. A.P.'s may be made according to routine methods and the patient can quite easily turn the injured limb himself for the lateral projection. A badly shattered lower limb might mean a plaster cast encasing the whole foot and ankle and extending the full length of the leg right up to the hip. Occasionally we receive a patient with both limbs so encased. The A.P. projections are made in the normal manner, but we do not turn the patient for the laterals. We take these horizontally.

Those who apply plaster casts to ankles and feet, give little thought to x-ray technicians and their problems. A walking cast may have several inches of plaster under the bottom of the foot, with a wooden rocker-shaped "sole", making it almost impossble to produce a decent outline of bone construction. Besides which, the radiologist will probably see a series of nails criss-crossing the bone fragments, these nails being those used to piece together the various thicknesses of wood which go to make up the heel or rocker "sole." The thickness of the sole and the nails interfere very considerably in both A.P. and oblique views and necessitates quite high exposure factors. However, they cannot be avoided, and

when a patient is sent to x-ray, the best pictures possible must be obtained. On arrival from overseas, the patients are immediately sent for x-ray examinations. The nature of the injuries must be demonstrated, the condition of healing or bone union must be noted, before any attempts are made to remove the cast. Therefore, the technician in a military hospital must be prepared to cope with all types of cast work and the problems relating thereto. While I have mentioned only those pertaining to the extremities, the taking of chest plates and doing spine jobs through casts call for special considerations.

The whole problem of war fractures is quite new to all concerned — from the first-aider who picks up the casualty in the field, to the final readjustment of the healing limbs by the doctors in the home hospitals. In many cases, portions of the bone are carried completely away, while in others, many fragments intermingle with foreign bodies such as small pieces of shrapnel. Extremities are often x-rayed between changes of casts, and oblique or semi-oblique views are quite often more suitable than a direct lateral. Fragments shown overlapping on a lateral view may be reported as "union," when oblique views taken at a later date will contradict this. In an effort to avoid this possible confusion, especially with regard to the lower limbs, we usually, in the lateral view, slightly rotate the foot downward and place a sand-bag under the heel, directing the central ray slightly posterior to the tibia. This projects, in most cases, a clear view of both tibia and fibula. Due to the fact that these patients are radiographed at regular intervals, for the purpose of noting conditions of healing, union progress, etc., every case is callipered each time he comes to the table, whether the limb be in plaster cast or not. This ensures the same technique factors being used. Truly comparable films are impossible when the radiographing is left entirely to chance or the judgment of different technicians.

In preparing the foregoing, I have endeavoured to avoid any form of text-book routine, and regarding the matter of techniques, individual technicians will be guided by their own experience and the capacity of the machines they operate. We do practically all extremity work at 40-inch focal film distance, using 150 MaS for cardboard folders and 10 MaS for screens. K.V.P. according to measured thickness. Doubling the exposure time for plaster casts is usually sufficient, but there are certain exceptions, such as I have mentioned, when both MaS and K.V.P. have to be very considerably increased; occasionally almost to full capacity of the tube. In such cases, strain on the tube may be saved by halving the exposure time decided upon and subjecting the film to two exposures.

Elementary X-Ray Physics

PART 2

ELECTRICAL TERMS

By K. E. HALL, Toronto ★

Electrical Potential or Voltage:

THIS is simply a force which causes a flow of electrical current. It can be likened to the force generated by a pump in forcing water through a pipe, for without some force the water would not flow; without voltage there would be no flow of current. This force is measured in VOLTS by means of a voltmeter and in x-ray equipment these values may vary anywhere from 10 volts up to 85,000. When speaking of thousands of volts, the term KILOVOLT is used; that is, 1000 volts is equivalent to one kilovolt (Kilo = thousand). Hence 85,000 volts becomes 85 kilovolts, or abbreviated, 85 KV. A common source of voltage is the battery; however it would require a great many indeed to produce 85,000 volts. Such potentials are obtained from transformers which will be referred to later.

Electric Current:

From the above analogy, we see that an electric current is simply the flow of something. What is this something? It is the negatively charged particle, the electron. An electric current then is a flow of electrons, and the rate of flow is measured in AMPERES by an ammeter. However, in x-ray work the ampere is too large a unit to be employed and a smaller unit is used, viz: the MILLIAMPERE — that is 1/1000 of an ampere.

Resistance:

Just as a water pipe offers resistance to water flowing through it, so does a wire offer a resistance to electrons flowing through it. This unit of resistance is called the OHM and is measured by an OHM meter. In x-ray work, the values range anywhere from one OHM up to several thousands.

Continuing the above analogy, just as a large pipe will carry more water so will a large size wire carry more electrons or current with less resistance.

Summarizing:

VOLTAGE = driving force — measured in VOLTS.

CURRENT = flow of electrons — measured in AMPERES.

RESISTANCE = opposition to flow of current — measured in OHMS.

The above is represented schematically in figure 8.

Note that the switch must be "closed" for current flow. When the switch is open, even though there be a voltage or potential across the battery

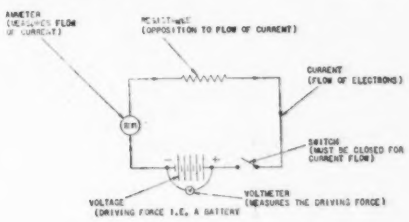


Fig. 8. Simple Electrical Circuit.

* Technical Service Dept. Victor X-Ray Corporation of Canada.

terminals, no current flows in an "open" circuit.

There is a definite relationship between the voltage, current, and resistance, known as OHM's LAW, given as follows:

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

or

$$I = \frac{E}{R}$$

Where I equals current; E equals voltage; R equals resistance.

Another term used in x-ray occasionally by the technician is the term "power". Power is simply the product of the voltage and current and is expressed in WATTS.

$$\text{Power} = \text{voltage} \times \text{current}$$

$$P = E \times I$$

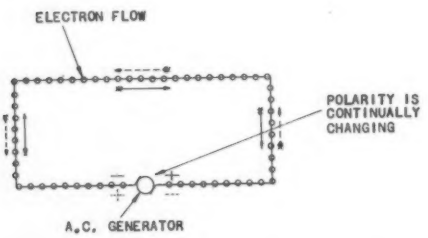
Where P equals power; E equals voltage; I equals current.

Types of Current:

There are two types of current used in x-ray equipment, viz: direct current (DC) and alternating current (AC).

Direct Current — (DC):

As the name implies, in direct current circuits the electrons flow direct from the negative pole of a battery or DC generator to the positive. The current is continuous and flows in one direction only.



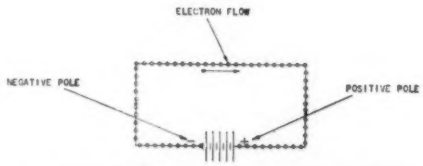
Electrons flow from the negative pole to the positive pole—in one direction only.
Fig. 9. Direct Current.

The commonest sources of direct current are the battery and the DC generator. A DC circuit is shown schematically in figure 9.

Alternating Current — (AC):

In alternating current circuits the electrons flow in one direction for a short interval of time, then reverse themselves and flow in the opposite direction. This is brought about by the fact that the terminals of the AC source reverse their polarity. At one time they are "negative and positive"; at another "positive and negative", and the electrons being negative are always attracted towards the positive pole. When this polarity is changed the electrons stop and reverse their direction of flow; that is, they alternate their direction and hence the name "alternating current."

An AC circuit is shown schematically in figure 10.



Electrons flow from the negative pole to the positive pole. The polarity is reversed and the electrons then flow in the opposite direction.
Fig. 10. Alternating Current.

As the reversal of the electron flow is not instantaneous, but requires a certain slowing down period and then a speeding up period in the opposite direction, the current will have different values at all phases of the AC cycle.

This relationship is shown graphically in figure 11 and is the standard method of representing alternating currents.

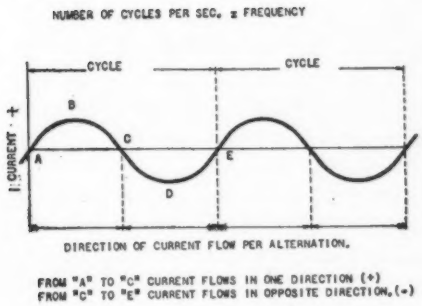


Fig. 11. Alternating Current Cycle.

At A the current is zero. It increases to a maximum at B and then falls to zero at C. At this point the electrons reverse themselves and flow in the opposite direction; rising to a maximum at D and then falling to zero at E. From then on the whole process or cycle takes place again.

A cycle, therefore, consists of a flow in one direction and then in the opposite direction back to the starting point. The number of cycles per second is called the frequency.

The maximum voltage attained at B is spoken of as the highest or peak voltage, and is measured in peak volts, hence the term, KILOVOLTS PEAK.

There are two main types of frequencies available for commercial use, viz: 60 cycle and 25 cycle. Most localities are supplied with 60 cycle current with the exception of a few communities in Canada and the United States where the frequency may be 50, 30 or 25 cycle.

MAGNETISM

If an ordinary bar magnet is placed beneath a piece of paper upon which has been sprinkled iron filings, it will be seen that the filings arrange themselves in a definite pattern. This arrangement of the iron filings is due to a magnetic field of force which surrounds all magnets. These invisible lines of force are closed curves leaving the north pole and entering the south, forming the magnetic field about the magnet. The above refers to a permanent magnet — that is, a magnet which retains its magnetism indefinitely. (See figure 12.)

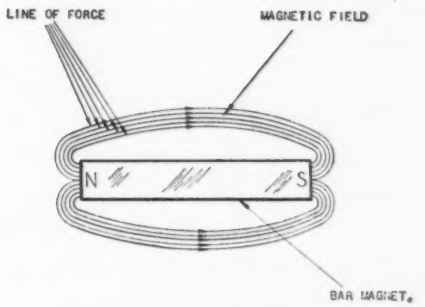


Fig. 12. Permanent Magnet.

If a soft bar of iron be wound with a series of turns of wire and connected to a battery (D.C.) as shown in figure 13, we have, when completing the circuit by means of a switch, an electro magnet, that is a magnet which is subject to the control of an electric current. When the switch is open the

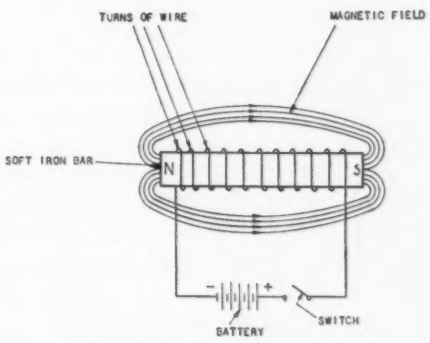
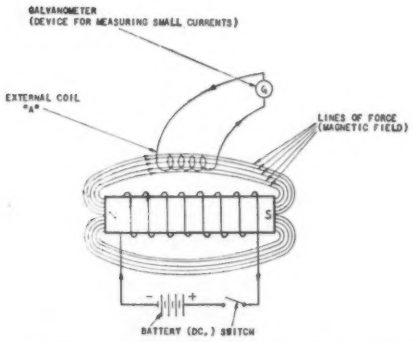


Fig. 13. Electromagnet.

bar of iron is unmagnetized and there are no magnetic lines of force present. When the switch is closed and the current commences to flow, lines of force are produced which build up gradually until the current reaches a maximum, when the number of lines of force remains constant. By simply opening and closing the switch, that is, varying the current flow, the number of lines of force surrounding the magnet may be made to increase or decrease.



When the battery is replaced by an A.C. generator the magnetic field is continually changing and is not constant as shown above. This results in a current being automatically induced in the external coil "A", that is, the above when connected to an A.C. source represents a simple transformer.

Fig. 14. Electromagnetic Induction.

Principle of Electromagnetic Induction:

Upon the discovery of the principle of electromagnetic induction depends most of our electrical apparatus in use to-day. Without this discovery, there would be no airplanes, automobiles, street cars, electric lights, washing machines, telephones or x-ray equipment.

This principle was discovered by Faraday in England and at the same time by Henry in the United States.

The principle stated briefly is, as follows: "If the number of lines of force passing through an external coil is changed then a voltage is induced which will cause an electric current to flow."

Referring to figure 14 in which A represents an external coil of wire placed in the magnetic field surrounding the electromagnet and connected to a galvanometer — a device for measuring very small currents, and if the D.C. circuit be closed or broken by the switch, it will be seen that the number of lines of force passing through the external coil of wire will be changed and hence from the principle stated above, a voltage will be induced which will cause a current to flow. Bear in mind, if the switch be remained closed, the current in the electro magnet will soon reach a steady state — which, in turn, means the number of lines of force passing through the external coil of wire will not be changing and hence no current will be induced.

Supposing that the electromagnet had been connected to a varying source of current, such as alternating current, what would have been the result?

Referring to the graphical representation of the alternating current cycle in figure 11, it will be seen that the current starts at zero, rises to a maximum and then falls to zero. This would mean that the number of lines of force about the soft iron bar would be continually changing, increasing, then decreasing, and so on as long as the switch remained closed.

Now, if an external coil of wire were placed in the immediate vicinity the number of lines of force passing through it would be continually chang-

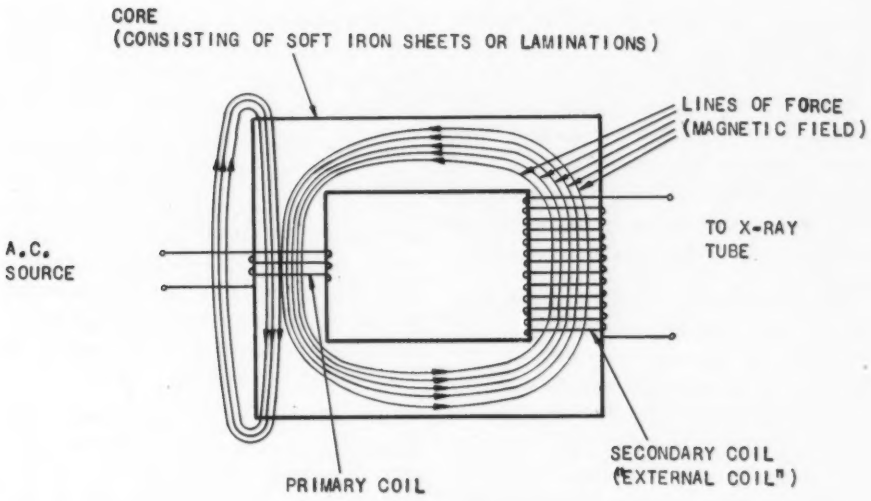


Fig. 15. Transformer.

ing and there would be induced therein a current similar in nature to that flowing in the electromagnet — a current which will be induced as long as the switch remains closed.

Note that with Direct Current, the switch would have to be mechanically closed and opened to induce a current in the external coil; however with alternating current the effect takes place automatically due to its cyclical nature.

This, in brief, is the theory of operation of the transformer and it will be noted from the above that a transformer will only operate on alternating current, for if direct current were employed voltages would only be induced when the switch was opened or closed. In the early days of x-ray such a device was employed to make and break the circuit and was called an interrupter. However, owing to its mechanical difficulties it was soon replaced by the transformer which, when connected to an AC source, requires no mechanical make and break for its use.

Summarizing, then, there are two ways of producing induced currents:

(1) By mechanical interruption of the D.C. circuit which would cause a changing magnetic field. In the early days of x-ray, the induction coil operated on the above principle. The coil is no longer used in modern roentgenology and will not be discussed here.

(2) By energizing the coil by a type of current which is continually changing both in direction and in quantity, that is A.C., which automatically produces a continually changing magnetic field. This is the principle of the transformer which is an essential part of any x-ray equipment.

The Transformer:

A transformer is simply a number of soft iron sheets or laminations put together to form a core as shown in figure 15.

On one leg of the core, called the primary, is wound a coil of wire — while a similar coil (comparable to the

"external coil" in figure 14) is wound on the other leg, called the secondary. When the primary A.C. circuit is closed, the resultant magnetic field continually changes, and as the soft iron core forms an excellent path for this magnetic flux or field, the changing magnetic field induces a current in the opposite leg of the core or secondary.

The magnitude of this induced current in the secondary depends upon the ratio of the number of turns on the primary to those on the secondary. For example, suppose for every turn on the primary, there are 1000 turns on the secondary, that is, the turn ratio is a 1/1000, then for every volt supplied to the primary, disregarding transformer losses, 1000 volts is taken from the secondary, and if 85 volts A.C. is supplied to the primary, 85,000 volts or 85 kilovolts is delivered at secondary terminals. Such a transformer is called a "step-up" transformer or high tension transformer (figure 16a) and is the standard method of supplying high voltage to the x-ray tube.

Another type of transformer is the "step-down" or filament transformer (figure 16b) and is is exactly similar to the step-up transformer except there are more turns on the primary than there are on the secondary.

As the name implies, the voltage is stepped down, for there are certain parts of the x-ray equipment that operate on low voltages, such as the filaments of the x-ray tube and the kenotron and as the 110 v. A.C. commercial supply is too great a voltage for these filaments, it is reduced by means of this type of transformer

In modern x-ray equipment the transformers are designed with a much closer coupling than indicated in the drawing, that is the primary and secondary are wound on the same core. The high tension and filament transformers are immersed in oil, for the oil acts as an insulator preventing spark-over between the secondary and its surroundings. This not only provides better insulation, but has the advantage of allowing the heat to be dissipated more rapidly by means of convection currents.

Although the theory of operation of the transformer has been considered in

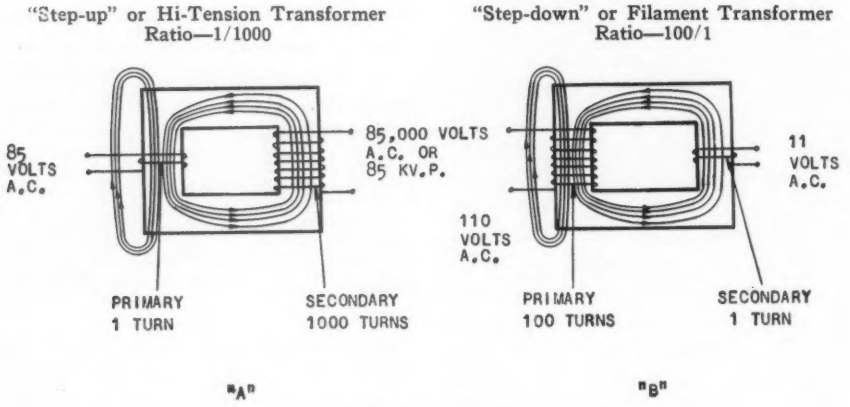


Fig. 16. Types of Transformers.

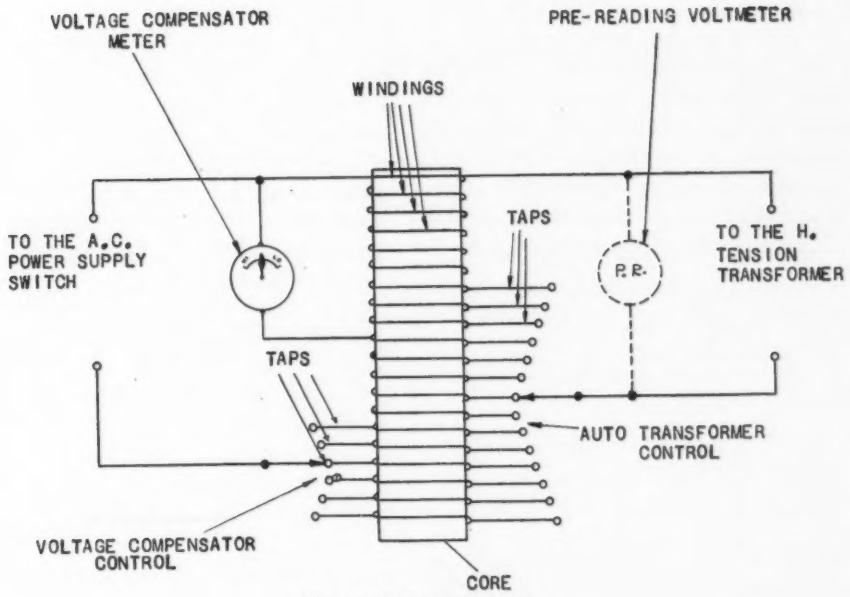


Fig. 17. Autotransformer.

some detail, it is hoped that its main use has not been overlooked — namely, it is simply an electrical device for transforming a low voltage to a high voltage, or vice versa — something that cannot be accomplished conveniently with direct current.

The x-ray tube actually operates on high voltage direct current, for once the A.C. voltage has been stepped up by the transformer, it is changed into a direct current of a pulsating type (rectification).

This high voltage D.C. could be obtained from batteries, but the number required and the space to house the same, would be prohibitive — to say nothing of the cost and insulation problems with such equipment.

The Auto-Transformer:

There is another type of transformer which is also essential to any x-ray equipment and that is the auto-transformer. In radiographing different parts of the body, different kilovoltage values are used and some method must be employed whereby the technician can set the control for any desired kilovoltage. Such a procedure is performed by means of the auto-transformer.

An auto-transformer operates on the same principle as the high tension and filament transformers. It is a transformer with only one winding which serves as the primary as well as the secondary.

Off one side of the winding is taken a series of taps, any one of which may be led to one terminal of the primary of the high tension transformer by means of a variable control (auto-transformer control). See figure 17. The other terminal is connected di-

rectly to one side of the 110 v. A.C. supply as shown. By altering the position of the variable control (changing auto-transformer button) voltages ranging from say, 40 to 85, may be applied to the primary of the high tension transformer with the result that a corresponding range of kilovoltages will be developed in the secondary.

It may be of interest to note that the clicking noise associated with the movement of the auto-transformer control is in reality the moving of the control from one tap to the next.

If a voltmeter be placed across the output terminals of the auto-transformer, as shown in dotted lines, we have a convenient method of checking the input voltage to the high tension transformer. This is the pre-reading voltmeter employed in some of the x-ray units and is sometimes calibrated directly in kilovolts. Any variation in the 110 v. A.C. input voltage is compensated for by a different setting of the auto-transformer and this setting is determined by the reading of the pre-reading voltmeter. Thus a technician is able to maintain a constant voltage to the primary side of the high tension transformer with the result the radiograph can be duplicated from day to day regardless of any major changes in the incoming power supply.

The above does not refer to variations in the incoming power supply, which are occurring continually, but only those wide variations which occur during the course of the day. Variations in the power supply which occur continuously are taken care of by a stabilizer which will be referred to later.

Voltage Compensator:

In many units a voltage compensator is employed which does away with the pre-reading voltmeter and allows the auto-transformer control to be marked off directly in kilovolts.

By taking a series of taps off the other side of the auto-transformer as shown in figure 17 and connecting them to a voltage compensator control the technician is able to maintain a constant input voltage to the auto-transformer. This condition is registered on the voltage compensator meter, a meter of simplified design. The face of the meter is divided off into two sections, one marked "voltage high" and the other marked "voltage low."

By means of the voltage compensator control, the needle of the meter is adjusted so as to lie directly over the dividing line between the two sections. When this is done, then a definite voltage is supplied to the auto-transformer which can be maintained by the voltage compensator should any variation in the incoming power supply occur. In some localities it is quite possible that the voltage may be higher in the morning than at night. This is especially true in the winter time when power consumption is greater due to longer hours of darkness.

The use of the voltage compensator allows not only more efficient use of the main auto-transformer but also increases the life of the filaments of the kenotrons inasmuch as a constant voltage is always supplied. With a single auto-transformer and pre-reading voltmeter, the voltage across the filaments may vary considerably which would tend to shorten the life of the rectifier (kenotrons).

(To be continued)

Radiography of the Chest in Infants

By MARIAN J. WHEELER

Montreal, P.Q.

THE successful radiograph of the chest of an infant requires methods quite different to those used in adults. At the Children's Memorial Hospital in Montreal, we have developed a method of positioning that might be of some interest to the technician who has had little experience in this type of work.

All adult chest films are taken in the upright position. Infants' chest films should and can easily be done in this manner.

The baby is placed in a sitting position at the end of the x-ray table with the lower legs over the edge. An assistant keeps the infant in close contact with the cassette by holding the infant's arms around the cassette, placing his own thumbs on the back of the cassette.

For purposes of protection it is advisable that the assistant should wear a lead rubber apron and gloves, although we are careful not to use the same assistant too frequently.

In order to eliminate any shadow of the scapula from appearing on the radiograph, the shoulders must be pulled well forward, and the position held very securely. It is more satisfactory to have a nurse or an orderly,

rather than a parent, hold the cassette. The parent is apt to be nervous and for this reason does not hold the baby securely enough. A second assistant stands at the side of the infant, holding the head straight by placing the thumb and middle finger of one hand on the forehead. The other hand is placed on the back of the head, lifting a little to prevent sagging of the infant. The arm of the assistant must be raised high enough to insure that it does not obscure any part of the resulting radiograph. In the case of a particularly active baby it is sometimes necessary to have a third assistant hold the pelvis firmly against the cassette.

The object-film distance in children is less than for adults, and this factor can be of aid in providing better contrast. If a shorter focal-film distance is used, a correspondingly lower voltage may be employed. A distance of forty-eight inches has proven very satisfactory for radiography of infants' chests. As infants vary in size to such a great extent, to give positive technical details is rather difficult, but as a guide, a well nourished eight months old baby would require 50KVP. one fortieth second 300Ma. at a distance of four feet.

The exposure should be made just as the baby begins to inspire. The reaction time of the technician and the mechanical delay in the x-ray machine amounts to about one-half second. If you wait until inspiration is complete before making the exposure, the resulting radiograph will usually show that the baby has started to exhale. The necessity of obtaining a straight film and a good inspiration cannot be overemphasized. I would venture to say that a poorly taken chest film of a baby can cause the radiologist more headaches than an x-ray of any other part of the body.

In conclusion, may I remind the technician of the importance of having everything in readiness before placing the baby in position for the radiograph. An infant has excellent means of registering his disapproval and the longer he is kept waiting the more demanding he becomes, and the more difficult the task for the technician.

The Focal Spot

Journal of the Canadian Society of Radiological Technicians

EDITOR
LESLIE J. CARTWRIGHT

Volume 3 *April, 1946* *Number 2*

"All our ambitions should be devoted to a faithful fulfilment of duties towards others as well as to ourselves."—Roentgen.

EDITORIAL COMMENT

AT last the Convention date and place have been announced. It will be held on September 26th, 27th, and 28th, at the General Brock Hotel, Niagara Falls, Ontario. To the unitiated it may appear that this announcement is overdue—as indeed it is—but if members who feel aggrieved at the lateness of its announcement could look behind the scenes, they would realize the difficulties which have had to be surmounted. First we have the long distances of Canada to contend with in conferences involving a number of people and carried on by correspondence. Then, owing to the convention and travel bans having been lifted by the Canadian and U.S. governments, the hotels are overcrowded, with capacity bookings months ahead. As a consequence of this no reservations could be obtained until the Fall either in Toronto or Niagara Falls. However, from the standpoint of comfort a Fall meeting is preferable to a summer one and with the mild climate of the Niagara Peninsula the weather should be just comfortably cool at the end of September. Moreover, it allows more time for a thorough consideration by the membership of the numerous problems and resolutions to be debated at the Annual Meeting, some of which you will find on this and following pages.

A member recently mentioned an idea which might be usefully adopted by our Society. It appears that a group of some 600 school teachers in a Canadian city have for some time had an arrangement by which if one of their number dies, all contribute five dollars, thus raising $3,000 for the relatives of the deceased member. There is no overhead and the entire sum, less a small amount for postage, goes to the beneficiary. Quite often no member dies during the year and no levy is made, but occasionally it has been necessary to call on the members twice in one year, but never more often than that. This is no idealistic dream but has actually been working for some years. If such a scheme were adopted by our Society it might be preferable to make an annual levy of five dollars to obviate the possibility of occasionally having to call on the members twice. Also a certain amount of interest would accrue from the money in hand. There would be no obligation for members not in sympathy with the scheme to contribute, but of course neither would they participate in the event of death. A member who had studied the constitution states that there is nothing in the constitution of the Society to prevent us doing this; in fact, he says, one paragraph specifically covers it. So think it over and express your opinion to your delegate to the Dominion Convention so that it can be discussed at that time.

EDITORIAL COMMENT

We regret to report that our President, Mr. T. B. Hurst, has been confined to hospital for several months following a surgical operation. He is now at home recuperating and we are hoping that it will not be too long before he is able to resume his regular activities.

We hear that the use of the letters R.T., by qualified members of the C.S.R.T., is likely to be authorized at the coming Annual Meeting. A committee has also been formed for the purpose of designing and producing a suitable Diploma or Certificate of Membership. We hope that samples will be available for consideration at the Annual Meeting.

The delay in holding the Examinations is regretted by all, not the least of these being the officers concerned. They worked hard in organizing the examining set-up, but it must be remembered that arrangements had to be made with eight different provincial societies and the correspondence entailed consumed considerable time. Now that the machinery is set up it should be possible to hold future C.S.R.T. examinations without annoying delays. The following is a summary of the latest information available at the time of going to press:

Province	Papers Sent	Exam. Date
Alberta	17	April 13, 14
British Columbia	4	Not announced
Manitoba	8	April 15, 16
New Brunswick	3	April 12, 13
Ontario	23	April 30
Quebec	16	April 26
Saskatchewan	3	April 13
C.H.S. Lady Nelson	1	Not announced

May we suggest that you carefully read and consider the various pre-convention items which follow under C.S.R.T. News. They are all important to the welfare of the Society and it is your democratic right to express your opinion on them and let your delegate know your wishes. Moreover, if these matters are properly debated at the Provincial Meetings prior to the Dominion Convention, the Provincial Delegates can go to the Convention knowing to a large extend the wishes of those they represent and it should be possible to save valuable time at the Annual Meeting, where it is always found that there is more to be dealt with than the available time allows.

CONVENTION COMMITTEE ACTIVELY AT WORK

Just as we go to press comes the latest news on Convention arrangements. The Committee is as follows: Chairman: E. J. O'Brien, 11 Queen's Park, Toronto. Publicity: Hugh J. Menagh, 67 College Street, Toronto. Technical Papers and Exhibits: J. H. Coones, Peterborough Clinic, Peterborough, Ont.; Hotel Arrangements: F. G. Reason, Medical Arts Building, Toronto. Entertainment: R. H. Davidson, 30 Bloor Street West, Toronto. Social Convener: Mrs. Mary Cameron, 250 Main Street East, Hamilton, Ont.

This group has visited the General Brock Hotel, Niagara Falls, and found it admirably suited for handling the convention. A card will be sent to all members shortly on which they will be asked to make their hotel reservations and to state whether they will be giving papers and whether they can bring films and gadgets for the exhibit section. It is too early yet to give full details as to speakers but a programme will be sent to members later. It is intended to have a luncheon on the first day (Thursday, Sept. 26th), a dinner and dance on Friday and on Saturday evening there is a public dance in which those desiring may participate. Sightseeing tours around the Falls and district and over to the U.S. side will be arranged. Some members intend to stay over the week-end and enjoy the beauties of the district at their leisure. An invitation has been sent to the Buffalo Society and we hope to have a good attendance of visitors from that direction. Altogether the Committee seems to be energetically arranging an excellent programme and with a good attendance of members from all parts of the Dominion the success of the Convention should be assured. The July Focal Spot will carry full details of the Convention arrangements.

Notes from the Secretary C.S.R.T.

Concerning Amendments to the Constitution:

In line with the suggestion that all important decisions by your Board of Directors should be published in the official journal, herewith please find a report concerning a motion which was adopted by your Board of Directors at a meeting held in Montreal, May 30th, 1945.

"That the Board of Directors recommend to the general meeting that no steps be taken to change the constitution or the memorandum of agreement at this meeting, but that the president and the secretary, with power to add to their number, be a committee to report to the Board of Directors the national situation and the provincial situation, and, if necessary, to call a special meeting at any time to lay before the members of the Society the information they have received and their recommendations as to action."

In view of the above, would all those members who have any comments or ideas relative to this subject of amendments to the constitution please submit them in writing to the President, the Secretary-Treasurer. or Mr. Herbert M. Welch, Colonel Belcher Hospital, Calgary. Mr. Welch has a keen interest in this subject and has prepared a brief concerning this matter which appears on following page.

Re Nomination and Election of a Candidate to the Board of Directors by the Registered Members of the C. S. R. T.:

The Board of Directors herewith give notice that Mr. T. B. Hurst, of Toronto, will be retiring from office on September 30th, 1946. In the ordinary course of events Mr. P. E. Hunt of Saskatoon will assume the presidency at that time, thus creating a vacancy which should be filled by a candidate representing the registered members.

It should be pointed out that nominations may be made by any five registered members by delivering to the secretary-treasurer of the C. S. R. T. with the nomination, the written consent of such nominee to accept office, if elected.

This matter should be receiving your attention now. Nominations should reach the secretary-treasurer not later than August 1st, if we are to complete all the arrangements in time for the annual meeting.

It should also be noted that the nominee who is finally elected will hold office for a term of two years. During the first year as vice-president and secretary-treasurer, and during the second year as president.

Following the receipt of nomination papers by the Secretary-Treasurer of the C.S.R.T., ballot papers will be printed and distributed as follows:

Not later than August 15th, sufficient copies of the ballot papers will be sent to the secretaries of the various Member Societies. The number so forwarded will be based on the returns as to paid-up membership submitted by those secretaries. These secretaries will attend to the distribution of the ballot papers so that they will reach those entitled to receive them, not later than September 1st.

The members will return the marked ballot papers to the Secretary-Treasurer of the C.S.R.T. in an envelope plainly marked "X." They should reach the Secretary-Treasurer not later than September 15th.

The ballot papers will be opened and counted at the annual general meeting by scrutineers appointed for that purpose. The name of the successful candidate will be announced at that meeting.

The above information is brought to your attention at this time by your Board of Directors so that you might take immediate steps to seek out an individual of your own choice worthy to fill this very important office.

Resolutions:

The formation of a resolutions committee is now in progress. In fact, may be completed by the time this goes to press. In the meantime, it has been thought advisable to publish for purposes of study only, resolutions which are at hand for presentation to that committee, and some other material from which it might well be that resolutions could be prepared.

It is not to be inferred that these resolutions will be presented to the annual general meeting exactly as they are here printed. That will depend upon the action recommended by the resolutions committee to the Board of Directors. In the meantime, you might give these resolutions and articles some thoughtful consideration. You might even discuss them at your local meetings and submit your suggestions or ideas to the chairman of the resolutions committee through your executive officers.

Resolution submitted by the Nova Scotia Society of Radiographers—"Whereas the radiologists are represented at OUR annual meeting, be it resolved that a delegate from the Canadian Society of Radiological Technicians attend the annual meetings of the Canadian Association of Radiologists, in order to give support to any motion proposed there in our favour."

Resolution submitted by the New Brunswick Society of Ex-Ray Technicians—"Whereas it is obvious that in numbers there is strength, and whereas we desire the Canadian Society of Radiological Technicians to be strong, it is the opinion of the New Brunswick Society of X-Ray Technicians that technicians trained in a hospital not equipped for x-ray therapy, who apply for membership in the Canadian Society, be not required to answer questions on x-ray therapy. It is our opinion that the deletion of these questions would not weaken the value of their members, or lower our Society's standards."

Classification of X-Ray Technicians:

A proposal by the Alberta Society of Radiological Technicians:—

"After much discussion both with technicians and radiologists, the Edmonton executive would like to present the following proposal to the Dominion Society for consideration.

"We feel that it is desirable to have a classification of technicians in our Dominion Society with separate certificates issued for radiographic and therapy technicians. We believe that a student writing an R.T. in radiography should spend the required time in radiographic work, write examinations on darkroom technique, physics and apparatus, anatomy and present demonstration films. Whereas, a student wishing to qualify for an R.T. in therapy should spend the required time in x-ray therapy and be subjected to oral quiz by the district examiner at the time of writing examinations. The written examinations should deal with physics and apparatus as well as general questions on general therapy technique.

"A student may have either certificate or both, but would have to qualify for each separately. In this way when a radiologist hires a technician he knows exactly what qualifications he or she may have.

"At the present time, a student may write the Dominion examinations with only a theoretical knowledge of therapy and still pass the written examination, which entitles him to a certificate to operate both a radiographic department as well as a therapy department. Now, if this technician is hired where therapy is required, the practical application of his theoretical knowledge is liable to be sadly lacking and the R.T. of the said technician becomes of very little significance. There are many instances where x-ray therapy equipment is not available, and the student cannot receive practical training, so why should they write and receive certificates on something of which they have no practical knowledge? Practical training, we believe a major factor, and in evaluating a technician's practical knowledge we feel that an oral quiz by the district examiner would be of great value.

"The radiologists themselves have found that x-ray therapy and radiographic or diagnostic work are two distinct fields, and accordingly they issue two separate certificates. Surely if there is enough justification for the classification of radiologists, there must certanly be a necessity for the classifying of technicians."

Training Facilities:

A survey is being conducted of all available training facilities throughout Canada. This work has been undertaken by Mr. Herbert M. Welch of Calgary.

All Associate Directors and Executive Officers of Member Societies are requested to give Mr. Welch every assistance toward making this survey as complete as is possible.

—P. E. HUNT,
Sec'y.-Treas., C.S.R.T.

Herewith the Editor presents the two sides of the problem of whether or not the Constitution should be changed so that the offices of Vice-President and Secretary-Treasurer will be separate. As things stand at present the Vice-President and Secretary-Treasurer are one and as the Constitution calls for the Vice-President to become the next President, it means that we cannot retain an officer in the highly technical position of Secretary-Treasurer for more than one year. Conversely it means that the President must have served a year as Secretary.

First the statement in favour of changing the Constitution as presented by Mr. H. M. Welch:—

SUGGESTED CHANGES IN CONSTITUTION

At the coming General Meeting a resolution is to be presented which proposes the formation of a committee to make a study of suggested amendments to the Constitution of the C.S.R.T., and to bring their recommendations before the General Meeting in 1947.

The purpose of this brief is to enable our Member Societies to make a study of some of the suggested changes prior to the convention, so that the delegates may be able to express the views of the various Member Societies.

It is not my intention to take up valuable space in The Focal Spot by going into all the details of suggested changes; where it is proposed to change a major section it naturally follows that changes will be required in other sections which have a bearing on the one to be changed. The changes suggested chiefly concern the election or appointment of Directors and Officers.

Referring back to the convention held in Winnipeg in 1944 it will be remembered that a resolution was passed to change section 9, clause C.

This in effect means that a Director will be elected to represent each Member Society. If and when this resolution is put into effect there will then be no necessity for clause D of section 9 which states that "Two Directors shall be nominated by the ordinary members." The ordinary members will be represented by the director elected by their Member Society. In keeping with the above, clause 11B would need to be amended to read "Directors" instead of "Director," and clause 11C could be eliminated as the cancellation of 9D makes this clause unnecessary.

If the above changes were made then the election of Officers would be clarified, as the President, Vice-President and Secretary-Treasurer could be elected from the Directors under clause C. and could be so elected by the Directors themselves or by the delegates at the General Meeting. An Executive of the Board would be appointed to carry on the routine work of our Society. It is my opinion that the office of Vice-President and Secretary-Treasurer should be separated and held by two officers instead of one; this would mean a change in clause 12A.

Under the present method if for any cause our President is unable to carry out his duties then the Vice-President must take over the duties of President. This may happen at any time during the year or at the General Meeting as happened last year, and we must then appoint a temporary Secretary-Treasurer who may or may not be acquainted with the business of the Society. Under the suggested change we would not of necessity have to change our Secretary-Treasurer every year, for if we had a capable Secretary-Treasurer who was willing to carry on we would reap the benefit of the experience gained during the first year of holding office.

Again under the present set-up it prevents the Vice-President from having the honour of being elected President unless we are prepared to elect a new Secretary-Treasurer each year, which I consider is not in the best interests of our Society.

To sum it up, there may be members in our Society who we would like to honour by making him or her our President, but under our present constitution we cannot advance our Vice-President to this position until a year has been served as Secretary-Treasurer. We then lose a good Secretary-Treasurer just

when we would benefit, as stated above. We also may lose a good President because he or she may not be suitable or willing to act as Secretary-Treasurer.

The one other major change I suggest should be made is in section 32, which reads in part: "Every member shall have one vote at a General Meeting, etc." This, to me, is obviously unfair. A member unable to attend the convention is unable to exercise his vote; it also means that the Society in which Province the convention is being held can outvote the combined remaining seven Member Societies even though the official delegates present represent the large majority of the total membership of our Society. I believe the solution to this question would be that the Official Delegate be empowered to cast that number of votes equal to the number of ordinary members in good standing with the Member Society the delegate represents or, in other words. an individual member of the Society as such, shall have no right to vote at any General Meeting, all votes thereat being cast only by delegates duly accredited from the various Member Societies.

The above is submitted for your consideration, by me as an ordinary member of our Society, and not as a Director.

—HERBERT M. WELCH.

And now the statement against making a change, presented by Mr. P. E. Hunt:—

I THINK THAT THE BY-LAW SHOULD STAY

It strikes me that it should be an incentive to any person to know that his nomination and election to the Board of Direcors by the general body of membership ensures his eventual rise to the presidency. It should also be noted that no individual other than a member elected by the general body of members can ever attain that office. The very fact that the first year has to be served as vice-president and secretary-treasurer should not deter a right thinking individual from accepting such nomination.

My own experience would indicate that no better method of training an individual for the presidency could have been devised. The difficulty is in training the secretary-treasurer. It is intended apparently that this should be the responsibility of the president since he will have already held such an office. The new secretary-treasurer may therefore expect and should receive every possible assistance from the president.

What we really need then is a plan whereby someone is "groomed" for the office of secretary-treasurer before nominations and election. Surely there must be some way in which this can be accomplished without actually changing the by-laws. Something that can be done, although it may not be the answer, is to get more members at committee work. Their actions on such committees could be used as an indication of their probable efficiency on the Board of Directors.

Something else that has so far been overlooked is this: Your Board of Directors share with the general body of members the right to make nominations to fill that office. See by-law 17, (a), (b), (c). If, therefore, they become aware of an individual who is obviously of a calibre fit for nomination they should see to it that such nomination takes place. The candidate may not be elected but at least will have been brought to the attention of the members.

Due to circumstances affecting the presidency last year your present secretary received precious little training as far as the C.S.R.T. is concerned. He had served on the resolutions committee for a very short while. He has therefore to rely on instructions received from the President or the Board of Directors, plus the society's records and his own interpretation of the by-laws.

All your future secretaries will have very much this same problem to face. They will, however, if you hold to the constitution, have the advantage of a president who has acquired some knowledge of the administration of the affairs of the C.S.R.T.

The time is not far distant when the corporation will have to hire an assistant secretary, or failing this, the Board of Directors will have to appoint one. Authority for this exists under by-laws 13 and 14. Such an individual would not be a director and would do all the routine clerical work under the supervision of that director serving as secretary-treasurer. All correspondence would be addressed to this last individual but he would give his personal attention only to those matters which would seem to warrant it. The remainder with his instruction would be passed on to his assistant.

—P. E. HUNT,
Secretary-Treasurer, C.S.R.T.

News Items from the Provinces

BRITISH COLUMBIA

(continued from page 56)

fortunate in being able to find speakers who gave unstintingly of their time and we are very grateful indeed for their generous support.

Dues are still a bit of a bother to the Treasurer and as dues are necessary in order to carry on the activities of our Society I would like to appeal to all those who have not yet met this obligation to try and do so as soon as possible. The Convention will be along before we know it and funds are always very necessary for delegates' expenses.

If any members have anything to suggest for the improvement of the Society they can do so by sending in any resolutions to the Secretary.

No marriages or engagements have come to my knowledge recently. Everyone is beginning to look forward to annual vacations and although the weather in Vancouver has not been sultry so far this year, still our thoughts will wander to summer resorts.

—W. Q. STIRLING,
President.

MANITOBA SOCIETY OF X-RAY TECHNICIANS

The regular meeting of the Manitoba X-Ray Society was held in the Board Room of the Winnipeg General Hospital on Wednesday, January 16th. During the business meeting Mr. Axtell, president, announced the resignation of Miss Mary Hallam as secretary. We regret this very much because Mary did a splendid job last year. Miss M. Steski was appointed sub-editor for The Focal Spot for the coming year.

After the business meeting very interesting films were presented on "The Manufacture of Syringes and Needles and how to care for them." Our thanks to Mr. J. Zaschley for obtaining them for our enjoyment.

On Thursday, Febreuary 14th, the regular meeting of the Manitoba Society of X-Ray Technicians was held in the form of a dinner at Moore's, Winnipeg. After a very delightful dinner, an evening of card games and dancing followed. About eighty-five were present; what an excellent turnout! We were happy to welcome so many ex-service people.

An evening like this makes us better acquainted, so why not attend our regular monthly meetings so that we'll get to know each other better? Our hearty appreciation to the program committee for a very pleasant evening.

On Wednesday, March 13th, the Manitoba Society of X-Ray Technicians held their regular meeting in the Board Room of the Winnipeg General Hospital. Mr. E. M. Campbell of the Manitoba Cancer Relief and Research Institute gave a highly interesting and informative talk on "A Continuously Evacuated Tube for Deep Therapy."

Sergeant E. D. Tucker gave an exceedingly colorful talk on "Life of an Army X-ray Technician Overseas." Mr. Tucker concluded his interesting talk by stating how important whole-hearted co-operation, on the part of each individual, was to an army medical unit and that this same whole-hearted co-operation applied to our own provincial society would spell success.

—M. STESKIE,
Sub-Editor.

NEW BRUNSWICK SOCIETY OF X-RAY TECHNICIANS

A regular meeting of the New Brunswick Society of X-ray Technicians was held at St. Joseph's Hospital, Saint John, N.B., at eight o'clock, January 31st, 1946. Fifteen members were present and Miss Margaret Grant, the president, was in the chair.

We had expected the pleasure of having a lecture from Capt. Pearl Gould, R.C.A.M.C.,

but shortly before our meeting, she was transferred to Vancouver, B.C. Dr. W. J. Fisher, Provincial Hospital, Fairville, N.B., was then to be special speaker but considered his subject too lengthy for one meeting. We hope to hear him in the near future.

Through the kindness of the Sisters at the hospital, an interesting moving picture, on excretion urography and retrograde pyelography was shown. Refreshments were then served to complete a very enjoyable evening.

Mr. P. J. Nadeau suggests that each member of the C.S.R.T. be issued a small button or badge to wear to show he belongs to the Canadian Society. This badge could have an x-ray tube stamped on the face of it. Has this ever been suggested before?

—J. RUSSELL MORSE.
Sub-Editor.

NOVA SCOTIA SOCIETY OF RADIOGRAPHERS

Regular and special meetings have been concerned with preparation of what we hope will be the very best Refresher Course that Nova Scotia has yet seen. This will be opened by the Mayor of Halifax on the morning of May 15th and will continue for three days, with a line-up of very interesting speakers from medical, radiological and technical sources. Social appeal is taken care of by the Annual Banquet at the Nova Scotian Hotel, a Supper in honor of new officers, at Camp Hill Hospital, and a Tea to close the sessions at the Halifax Infirmary.

We were sorry to hear of the death of the father of our Second Vice-President, Miss Claire McGratton; also of the husband of Mrs. Angus MacIntosh (nee Margaret Gillies). Our sincere sympathy is extended to these members in their bereavement.

—SISTER EDMUND CAMPION,
Secretary.

ONTARIO SOCIETY OF RADIOGRAPHERS

CENTRAL SECTION

The second meeting of this season was held at the X-ray and Radium Industries Limited on Saturday, March 2nd, 1946.

There were 76 members present and Mr. Jack Coones of the Peterborough Clinic gave us a very instructive demonstration on Density, Contrast and Detail.

Major A. Burk, Radiologist, Christie Street Hospital, demonstrated the use and advantage of planagrams with some very interesting x-ray films and equipment.

Dr. W. J. Cryderman, Radiologist, Toronto Western Hospital, had a very fine collection of films on the examinations of the Upper Gastric Tract.

Mr. M. Pochon, Radium Chemist, showed a movie on Radium Mining and his subject proved very interesting.

After the meeting was over we had refreshments with our host, Mr. R. H. Kidd, who is now connected with X-ray and Radium Industries.

The last meeting of this season for this section will be held at the Royal York Hotel, Toronto, in Dining Room number 10 on Thursday, May 23rd, 1946, starting at 7 p.m. Your committee has arranged another very interesting programme with papers by Mr. Leslie Cartwright, Hospital for Sick Children, on Radiography of Children; Mr. Wm. Page, Toronto General Hospital, on Pyelography; Mr. Kenneth Hall on the Evolution of X-ray Tubes, and at least one Radiologist.

This being our last meeting before our convention in Niagara Falls, Ont., in September, your committee would like very much to get this programme started on time as we are being entertained by our associate members after the meeting. The Central Committee wishes to take this opportunity to invite any of our members who are not in this section to this meeting.

—J. H. GUTHRIE,
Chairman.

QUEBEC SOCIETY OF X-RAY TECHNICIANS

The third General Meeting of the Quebec Society of Radiographers was held in the Women's General Hospital on the 16th of February. Miss Ruth Loeb gave an interesting address on the "Radiologist and the Technician." This was followed by a French paper by Sister Margaret of Jesus on "Visualization of the Gall Bladder." Sister had some very excellent films to demonstrate her paper.

Miss Donalda Campbell acted as Chairman in the absence of our President, Miss Jeanne Gagné, who underwent a serious operation, but we are glad to state she is now well on the way to recovery.

During the business session, Mr. H. H. Lewis thanked the members for their kindness to him when he was overseas and for keeping him posted in the doings of our Association.

A letter from Mr. Cartwright was read by Miss Rosemary O'Hagan, sub-editor of The Focal Spot, asking for articles for our magazine. May I add here that it does good to stir up your members, for since then I have received three articles. So take a tip and try a little canvassing, sub-editors.

At the close of the business meeting we all adjourned to the living-room where most elaborate refreshments were served.

A special executive meeting was called March 9th at the Royal Victoria Hospital. Miss Wheeler, secretary, read a letter of resignation from Miss Jeanne Gagné who stated that although she was feeling much better, her doctor had advised her to resign from office for the remainder of this term. We all regret the loss of Miss Gagné.

Miss Campbell, as Vice-President, is shouldering this new responsibility and has already arranged an excellent programme for April 6th, at the Hotel Dieu Hospital.

We were all grieved to hear of the serious skiing accident Miss Lynn Holland of the Children's Memorial Hospital had a few weeks ago, and hope that it is not as serious as was first believed by the doctors of the Neurological Institute. We trust that, with the skilled care she is having, Lynn will soon be back on her feet again.

Miss Rosemary O'Hagan was approached by Miss Grace Gardner, Principal of the Montreal Protestant High School and Member of the Education sub-committee of the McGill Alumnae Society, to address the graduating class of the Protestant High School girls of the Island of Montreal at their Career Conference on February 19th. Subject, "Qualifications required and duties of an x-ray technician." A great deal of credit should go to the organizers of these Career Conferences for they certainly are a wonderful help to the girls starting out on careers. About 65 attended the x-ray talk and all displayed the keenest interest by asking numerous questions.

A series of lectures is being given the week of March 11th, at the Victor X-ray Office, Medical Arts Building, by Mr. K. E. Hall, for the Sisters of the Catholic Hospitals.

On March 18th lectures are taking place at the Montreal General Hospital, Western Division, also by Mr. Hall, on the "Fundamentals of X-ray Physics" for our Student Technicians, and for the week of the 26th a refresher course for the Senior Technicians.

We are all looking forward to seeing and hearing from our old friend, Mr. Hall.

Once again our Executive is showing a great deal of enthusiasm preparing for our Annual General Meeting in May. Most of the guest speakers have been secured and we hope to make it a really interesting and enjoyable day for all our members.

—ROSEMARY O'HAGAN,
Sub-Editor.

SASKATCHEWAN SOCIETY OF X-RAY TECHNICIANS

Mr. George Jackson has returned from overseas and is now back in civilian life as head technician at the City Hospital, Saskatoon, Sask. The best of luck, George.

We are glad to welcome home from the Air Force Mr. George Tokarek who also has resumed his duties at the City Hospital, Saskatoon.

Miss Gertrude McDougall has accepted a position in the x-ray department of the Grey Nuns' Hospital, Regina, Sask.

Many enquires are being received from students wishing to write the examinations, and several from those wishing to know where x-ray training may be had.

The Secretary has sent out letters to members asking where and when they wish to have their next annual meeting, but he informs me that the response has not been very encouraging. Please take note of this, members, as we have much important business to attend to as well as the election of officers.

Dr. L. C. Hacking has returned from overseas and has resumed his duties as director of the Radiological Department, Regina General Hospital. Sask. —S. G. JOHNSTON, Sub-Editor.

POSITIONS WANTED

FELTHAM, Ernestine, age 32, single, 21 Cottage St., Truro, N.S. Desires employment in the Maritimes.

LUDWIG, Leonard Arthur, age 28, married, 194 Good Street, Winnipeg, Man.

MATTINSON, Harold Norman, age 33, married, 43 Union Street, Truro, Nova Scotia.

PAJUIN, Marie Fernande, age 29, single, 91 Regent Street, Port Arthur, Ontario.

PATRY, Thomas John, age 27, married, 1294 York Street, London, Ontario.

For further information relative to any of the above applicants, please write to the secretary-treasurer of the C.S.R.T., P. E. Hunt, 1215 7th Ave., Saskatoon, Sask.

POSITIONS VACANT

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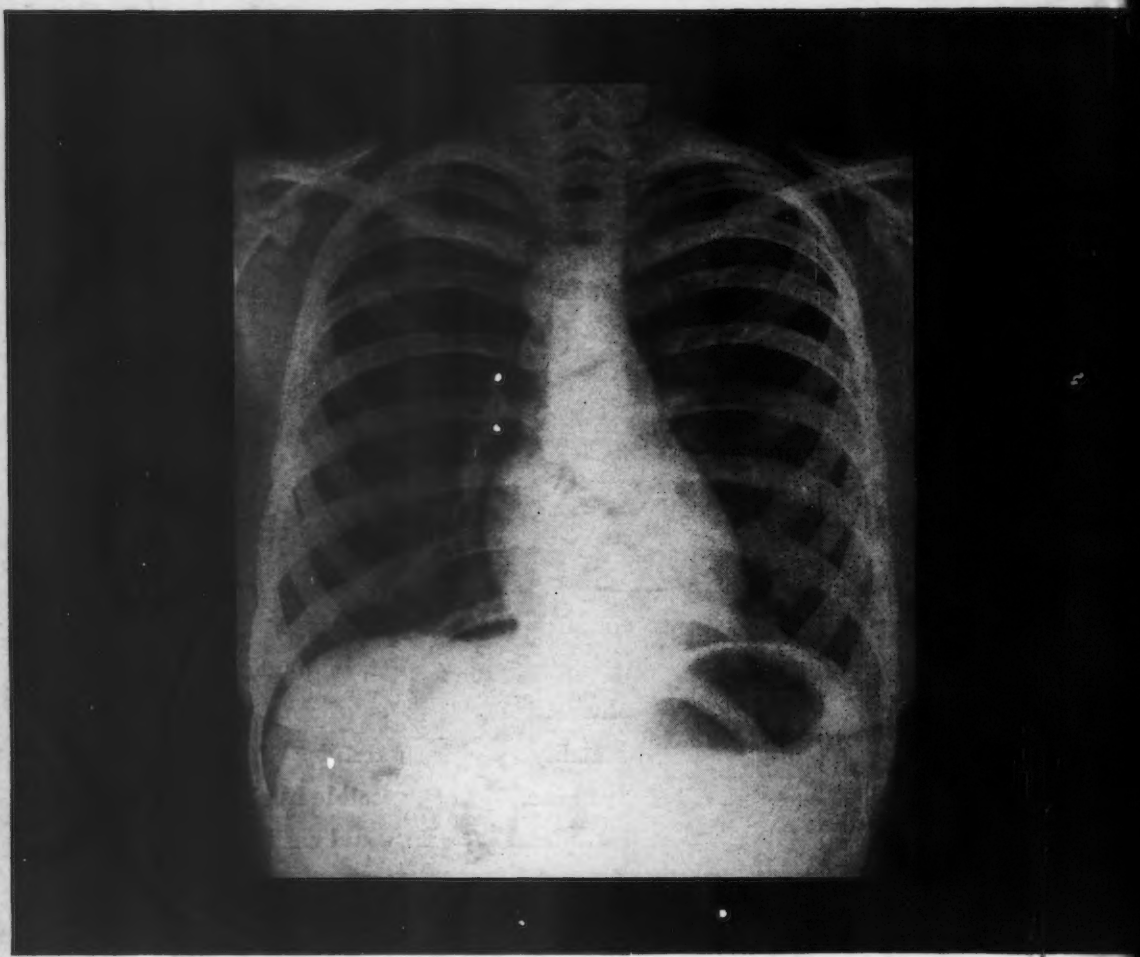

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